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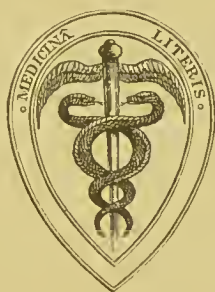


A TEXT-BOOK  
OF  
MATERIA MEDICA

FOR STUDENTS OF MEDICINE

BY  
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## PREFACE

THE object of this book is to serve as a guide to the British Pharmacopœia and as an introduction to pharmacology and therapeutics. It is intended mainly for students of medicine, but is also designed to meet the wants of students taking Section E of the final examination for the Associateship of the Institute of Chemistry.

An endeavour has been made to lighten the labours of students by putting the less important matter into small type, distinguishing between the more important and less important ingredients in preparations, printing the principles of crude drugs which it is necessary to remember in heavy type, and giving a figure of all those drugs which possess distinctive characters that can be portrayed. By confining the pharmacology almost to the action of drugs on man, giving the effect of therapeutic doses and the ill-effects to which the drug may give rise, and briefly describing the action and uses of the various preparations, an attempt has also been made to render the book as useful as its limits would allow.

The figures, with the exception of six (figs. 79, 80, 90, 119, 120, 121), are original, and are intended to represent such specimens of drugs as the student is likely to meet with in the *Materia Medica* museum.

Although the book does not deal with experimental pharmacology, the results obtained by it, which are of practical importance, are mentioned, and in a few cases, where it is deemed necessary, experiments on animals have been described.

In treating of inorganic substances it has been impossible to avoid referring to the current theory of solution, and the earlier part of the pharmacology is founded mainly on the ionic hypothesis. So long as it is recognised that this theory is an hypothesis and that it simply denotes that in aqueous solution most inorganic compounds are changed into something different from the original, no serious objection can be raised to the method of speaking of the action of ions.

The latter half of the book has been divided mainly on chemical lines because it was felt that this classification gave the student the best idea of the active principles of drugs and incidentally of their pharmacological actions. The weak point of the method is due to our ignorance of the chemistry of many important drugs, but it possesses the advantage of drawing the attention of students to this fact. So far as is consistent with the classification adopted the drugs most closely allied in pharmacological action have been most closely associated.

The chemistry of the drugs has been brought into line with the most recent investigations, and as far as possible constitutional formulæ have been given of the more important active principles. This has been done mainly because new drugs are often slight modifications of old ones, and it is desirable that medical men should have some knowledge of what they are. It is almost unnecessary to state that the chemical formulæ are not intended to be learnt.

A licence has been taken in speaking of the presence of sodium, calcium, sulphates, &c., as impurities in drugs; but as this is the usual terminology of the chemical laboratory, it is not likely to lead to error. In a few cases the arrangement required by the definition of a preparation given on page 1 has been departed from as being more convenient.

The elementary character of the book precludes references being given in the text. Many original papers have been consulted and a number of experiments have been made.



I desire, however, to acknowledge help which I have received from the following works :—Greenish's 'Introduction to the Study of Materia Medica,' White and Humphrey's 'Pharmacopœia,' Squire's 'Pocket Companion to the British Pharmacopœia,' Walker's 'Introduction to Physical Chemistry,' Meldola's 'The Chemical Synthesis of Vital Products' (Vol. I.), Comey's 'Dictionary of Chemical Solubilities,' Schmidt's 'Ueber die Erforschung der Konstitution und die Versuche zur Synthese wichtiger Pflanzen-alkaloide,' Brühl, Hjelt und Aschan's 'Die Pflanzen-alkaloide,' van Rijn's 'Die Glycoside,' Autenrieth's 'Auffindung der Gifte,' Dragen-dorff's 'Die Heilpflanzen,' Wiesner's 'Die Rohstoffe des Pflanzen-reiches,' Beilstein's 'Handbuch der organischen Chemie,' and in the preparation of the Appendix, Humphry's 'Materia Medica,' Watt's 'Dictionary of the Economic Products of India,' and Dymock, Warden, and Hooper's 'Pharmacographia Indica.' The matter in inverted commas has been taken from the 'British Pharmacopœia.'

I also gratefully acknowledge my indebtedness for help and suggestions to Professor James Walker, D.Sc., F.R.S., H. A. D. Jowett, D.Sc., and J. H. Wigner, Ph.D. Dr. Wigner read the manuscript and Dr. Jowett the proofs.

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## TO STUDENTS OF MEDICINE

The matter in small type is of subsidiary importance, and a knowledge of it is not required for most examinations.

Of the matter in ordinary type, that dealing with the origin and characters of crude drugs need not be learnt in detail; it is generally sufficient to be able to identify crude drugs on inspection.

The things which must be remembered are those which bear upon prescribing and the treatment of disease: such are the names of the various preparations and the amount of active constituents they contain; the doses; the solubilities of drugs and their preparations in water and, in some cases, other media; the pharmacological actions and therapeutic uses.

The active principles, it is advisable to remember, are printed in heavy type. The chemical formulæ of these, where given, are not intended to be learnt; they have been introduced merely to give some idea of the chemical constitution of these substances.

Great care must be exercised in tasting drugs having a dose of less than half a grain.

It is perhaps necessary to draw attention to the fact that the scale of the figures is in *linear* measurement.

# MATERIA MEDICA

## INTRODUCTION

**MEANING OF TERMS.**—**Materia Medica** originally included all that was known of remedial agents. Now it denotes simply the name, origin, and characters of the substances used in medicine. It is sometimes called **pharmacognosy**, but this term is more frequently applied to a detailed study of the anatomy of vegetable drugs.

**Pharmacy** is the art of preparing drugs so as to fit them for their use in medicine. In the case of crude drugs it consists largely of dissolving out the active principles by suitable media, and, where necessary, converting the extract thus obtained by further manipulation into a form suitable for use in the treatment of disease. The various forms into which drugs are made to enable them to be employed in medicine are known as ‘preparations.’<sup>1</sup>

The isolation of the principles of crude drugs, and the determination of their chemical composition and physical characters, constitute a branch of pure chemistry often called **pharmaceutical chemistry**.

**Pharmacology** is the science dealing with the action of substances on living organisms. Such substances as are used in the treatment of disease are familiarly spoken of as ‘drugs.’

**Toxicology** is concerned with the action of substances in doses sufficient to imperil life, their isolation from the fluids

<sup>1</sup> For the purposes of this work a ‘preparation’ is a form containing the parent drug or some of its constituents in a chemically unaltered state.



and tissues of the body, and the most appropriate treatment for these conditions.

**Therapeutics** is the art of treating disease.

### A PHARMACOPŒIA

In all civilised countries a book dealing with most of the drugs in common use and containing a description sufficient for their identification, a standard of purity, the method of obtaining certain preparations from them, and the doses in which these or the crude drug may be administered, is 'published by authority.' This book is known as the **Pharmacopœia**. It is mainly an intermediary between the pharmacist and the physician. Anything ordered by the latter unless otherwise stated must be of pharmacopœial strength and purity. The pharmacist is absolutely bound by its ruling, any infringement being punishable by law. The physician, however, is not so bound. He may use whatever drugs or means he thinks fit in the treatment of disease and may administer the pharmacopœial preparations in doses larger than those stated if he thinks it necessary. In cases of mishap, however, from this cause he is liable to censure, if not actual punishment.

The doses of a Pharmacopœia usually vary within somewhat wide limits. The smallest dose is intended to represent the minimum efficient one *for an adult*, and is generally intended for repeated administration; the largest dose represents that which it is usually safe to give. In some Pharmacopœias a second maximum dose is added, which indicates the amount it is considered advisable to administer in one day.

As the sciences associated with materia medica are progressive, a Pharmacopœia needs periodical revision. Recent investigations may have shown that its descriptions require modification or that its processes are capable of improvement; new drugs are also constantly being recommended, and some may merit 'official' recognition; older drugs, on the other hand, may have fallen into disuse and may need deleting.

The Pharmacopœia official in Great Britain and Ireland is

known as the British Pharmacopœia (contracted to B.P.), and is revised about every ten years. The last edition was published in 1898. An addendum of drugs used in India and the Colonies was published in 1900 (see Appendix). As it is advisable for the student of Materia Medica to confine his attention during the early part of his curriculum to the substances in this work, they will be exclusively dealt with in the following pages.

#### **SYNOPSIS OF THE OFFICIAL MATERIA MEDICA.—**

The official drugs include substances from the animal, vegetable, and inanimate kingdoms. The **non-metals**, sulphur, phosphorus, iodine, and carbon, are official. Other non-metals—hydrogen, oxygen, chlorine, bromine, boron—occur only in combination, as acids, salts, &c.

Of **metals**, iron and mercury are official, but are only used in therapeutics in a finely divided state. Most of the other common metals are official in the form of compounds. Thus we have compounds of the alkali metals sodium, potassium, and lithium (to which we must add the radieal, ammonium); of the alkaline earths, calcium and magnesium; of the earths and heavy metals, aluminium, cerium, bismuth, zinc, copper, lead, silver, manganese, chromium, as well as of iron and mercury.

Of **synthetic organic substances** we have, belonging to the aliphatic or fatty group, alcohols, ethers, esters, acids, and sugars; belonging to the aromatic group, phenols, acids, esters, &c.

The **vegetable** kingdom is represented by whole plants or nearly whole plants (ergot, chiretta, lobelia); by parts of plants (leaves, bark, wood, root, rhizome, flowers or parts of flowers, flowering tops, twigs and seeds); by the products of plants—oils (fatty and volatile), exudations (gums, balsams, resins, &c.), alkaloids, glucosides, &c.

The **animal** materia medica is much less extensive. It contains whole animals (cantharis, coccus) and animal products (oily and fatty substances, wax, spermaceti, honey, ferments, &c.).

## VEGETABLE AND ANIMAL PRODUCTS

UNDER this head will be included those products of animals and plants which occur naturally and those which are obtained by the process of simple extraction or distillation. For want of a better classification they will be taken in the order of their importance.

**Alkaloids.**—No satisfactory definition of an alkaloid has yet been given. This is due to the fact that they vary considerably in chemical composition and only exist as a group in virtue of certain reactions and properties. The vegetable alkaloids may perhaps best be defined as nitrogenous vegetable products which have their nitrogen combined in the form of a closed ring.

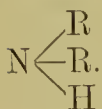
In 1880 König defined them as organic vegetable bases which are derivatives of pyridine. But, as it has since been shown that several alkaloids are not pyridine derivatives, this definition is insufficient.

The definition excludes certain oxy-ethylamine bases (cholin, muscarin, &c.) which possess alkaloidal properties and reactions, and includes the purine derivatives (caffeine &c.) which differ in some respects from most alkaloids.

Many of the alkaloids are tertiary bases, *i.e.* if regarded as ammonia derivatives all the hydrogens of ammonia are

replaced by organic radicals thus 
$$\text{N} \begin{array}{l} \swarrow \text{R} \\ \leftarrow \text{R} \\ \searrow \text{R} \end{array}$$
 A few are binary

bases; they have only two of the hydrogens thus replaced,



The general properties of alkaloids are as follows. Being *bases* their solutions change red litmus paper to blue, and they form salts with acids. In this respect they are comparable to ammonia and other alkalies; their name, indeed,



alkali-like, indicates this property. The purine derivatives (*e.g.* caffeine) are not bases in this sense. Most of the alkaloids are non-acid bases; a few are di-acid.

The majority of alkaloids contain carbon, hydrogen, nitrogen, and oxygen. They are colourless, odourless *solids* (berberine is yellow, sanguinarine red; both unimportant) and most are crystalline. They are decomposed by heat, with the exception of cinchonine, caffeine, and a few others which may be sublimed.

Pilocarpine is generally liquid but has been obtained crystalline. On heating it is converted into the isomeric *iso*-pilocarpine which can be distilled.

A few alkaloids (conine, nicotine, sparteine, &c.) contain only carbon, hydrogen, and nitrogen. They are *liquid*, have a distinct odour, and can be distilled.

Most alkaloids rotate the plane of polarised light. The majority of naturally occurring alkaloids are *lævo*-rotatory; a few are *dextro*-rotatory.

The *taste* of most is intensely bitter; of a few acrid and burning.

*Solubility*.—Most alkaloids are almost insoluble in water (pilocarpine, nicotine, curarine, and a few others are readily soluble), but soluble in organic solvents. On the other hand, their salts are for the most part readily soluble in water and insoluble in organic solvents (except alcohol). On this difference is based the principle of standardisation to be referred to later (page 53).

A few alkaloids (those which contain a phenolic hydroxyl group—*e.g.* morphine, cupreine, &c., and those containing a carboxyl or lactone group—*e.g.* narceine, pilocarpine, &c.), are soluble in caustic alkalies; the majority are insoluble. Alkaline aqueous solutions usually precipitate the alkaloid from solutions of its salts.

*Alkaloidal reagents*.—A characteristic property of the alkaloids and their salts is their sensitiveness to certain reagents, commonly called alkaloidal reagents, which precipitate them. These are iodine solution and solutions of many double iodides (potassio-mercuric iodide, potassio-bismuthic iodide, &c.), and certain conjugate acids (phospho-molybdic and phospho-tungstic being the chief). Tannic acid also

precipitates most alkaloids, but is less delicate as a reagent than the foregoing. Picric acid, auric chloride, and platinic chloride also form compounds, usually crystalline, with most alkaloids, which, owing to their fairly definite melting points, are of considerable service in the identification of alkaloids.

*Chemical Constitution.*—The chemical constitution of the great majority of the alkaloids is unknown. A few have been synthesised; a small number partially so; of the rest we know almost nothing. Many of them appear to be derivatives of pyridine, quinoline or iso-quinoline; atropine and cocaine contain a pyrrolidine group; morphine and its allies a phenanthrene group; while caffeine and theobromine are purine derivatives (see page 254). The simplest natural alkaloid is coniine. This has been shown to be *α*-propyl-piperidine.

*Distribution.*—Alkaloids are almost confined to dicotyledonous plants. They occur rarely in Monocotyledons (colehium, the hellebores), and are still rarer in the Cryptogams (impure alkaloids have been obtained from lycopodium and ergot). Among the Dicotyledons certain orders (Papaveraceæ, Solanaceæ, Ranunculaceæ, Rubiaceæ) are much more productive than the rest. The Composite and Labiatae contain scarcely any alkaloid-yielding plants whatever.

Generally, the same or closely allied alkaloids are found in nearly allied plants, but the same alkaloid may be found in species widely separated botanically. One alkaloid (berberine) is fairly widely distributed among Dicotyledons. When two or more alkaloids are present in the same plant, they are nearly always, if not always, closely allied in chemical structure. They are generally allied in pharmacological action. No authentic case of antagonistically-acting alkaloids occurring in the same plant is at present known.

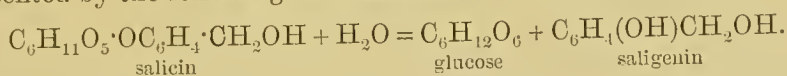
Alkaloids are generally found in all parts of a plant, but most abundantly in the roots, leaves, and seeds, and in the bark of trees; they occur, that is, in the more active tissues of the plant. They are believed to be by-products of protoplasmic activity which, not being further assimilable by the plant, are retained in the cell-sap and stored as secretions. They have almost certainly a biological function, protecting the plant, on account of their bitterness and poisonous properties, from the depredations of many herbivorous animals and possibly parasites. They occur combined with acids (malic, tartaric, &c.), in some cases—opium, aconite, cinchona—with special acids.

The following alkaloids are official in the British Pharmacopœia—Aconitina, Atropina, Caffeina, Cocaina, Codeina, Strychnina, Veratrina.

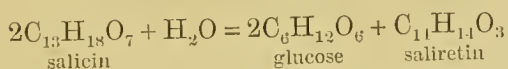
The following alkaloidal salts are official—Apomorphinæ Hydrochloridum, Atropinæ Sulphas, Caffeinæ Citras, Cocainæ Hydrochloridum, Codeinæ Phosphas, Hyoscinæ Hydrobromidum, Hyoscyaminæ Sulphas, Morphinæ Acetas, Morphinæ Hydrochloridum, Morphinæ Tartras, Physostigminæ Sulphas, Pilocarpinæ Nitrates, Quininæ Hydrochloridum, Quininæ Hydrochloridum Acidum, Quininæ Sulphas, Strychninæ Hydrochloridum.

**Glucosides** are characterised by the fact that they may be split up into a sugar and some other substance. Only one—salicin—is official as such in the British Pharmacopœia, but several of the pharmacopœial drugs owe their activity to members of this class (see page 355). Most are fairly soluble in water and in alcohol, but very few are soluble in ether.

The glucosides may be regarded as saccharine ethers. All artificial glucosides are such and probably all natural ones, but the manner in which the sugar molecule is combined in the case of most natural glucosides is unknown. It probably differs in different cases. They are generally easily decomposed by boiling with dilute mineral acids, but they behave somewhat differently to different chemical agents. Some are decomposed by boiling with water, especially under pressure; others need boiling in acid solution; a number may be decomposed by dilute alkalis. They are also decomposed by ferments at ordinary temperatures. This action is in nearly all cases specific, one ferment being capable of splitting up only one, or at most, a few glucosides. In most cases the ferment occurs in the same plant that produces the glucoside. The two substances do not interact in the normal state, because the ferment and glucoside are formed in different cells. When, however, the cell-walls are broken down by pounding or rubbing, with addition of water if necessary, both ferment and glucoside enter into solution and the interaction takes place. This is in all cases one of hydrolysis; the ferment, or the dilute acid or alkali, simply facilitates the interaction between the glucoside and water. The decomposition of salicin, for example, may be represented by the following end-reaction:



This reaction occurs when salicin is acted upon by the ferment emulsin or when warmed with dilute acids. If it is boiled with dilute mineral acids or heated with water under pressure to 150°C., saliretin is produced in place of saligenin, owing to condensation of two molecules of the latter.

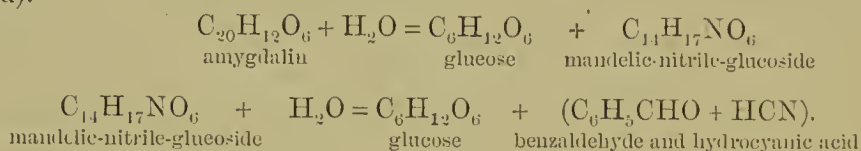


The number of molecules of water required by a glucoside for decomposition varies. In most cases it is only one, but it may be two or three. As in the case of salicin, the hydrolysis may vary with the conditions of the experiment.

The products of the hydrolysis also vary considerably. The sugar is usually glucose (hence the name of the group) but it may be rhamnose or other sugar; or two different sugars may be formed. The other product may be an alcohol, a mercaptal, phenol, ketone, an alkaloid (in the case of the so-called glyco-alkaloids), or even another glucoside. Thus Fischer showed that amygdalin was hydrolysed by yeast ferment into glucose and mandelic-nitrile-glucoside; the latter being further split up by



emulsin into glucose and benzcyanhydrin (benzaldehyde and hydrocyanic acid).



Glucosides are widely distributed in the vegetable kingdom. Only one (dhurrin) has been found in grasses, but they occur among the Pinaceæ, and are fairly abundant in the Liliaceæ. They are widely diffused among dicotyledonous plants.

As regards the part they play in the metabolism of plants, little definite is known. They occur most abundantly in the more active tissues of the plant, and one has been found to vary with the sex of the tree and the time of the year. They are probably intermediate and not final products, and play some part in the metabolism of the plant. As most are bitter, they may have also a biological function.

Comparatively few of the glucoside-yielding plants are employed in medicine. The most important are the members of the so-called digitalis group (nearly all of which, although widely separated botanically, yield glucosides), and certain plants yielding purgative substances (see page 355). Cherry-laurel leaves and bitter almonds owe their activity to the hydrocyanic acid which results from the decomposition of the glucoside amygdalin; and mustard, to the oils of mustard resulting from the decomposition of the glucosides, sinigrin and sinalbin (see pages 364, 369).

*Saponins* are glucosides which form a lasting froth when their aqueous solutions are shaken, and have the remarkable property of dissolving red blood-corpuscles (see page 374).

**Neutral Principles** are active principles of plants which it is difficult to classify. Their chemical composition is almost unknown and they possess few common properties. Most have a bitter taste. They are not basic. The group includes pure bitter principles (calumbin, picrosmin, &c.), to which it will probably be finally reduced; principles having a markedly irritant action (cantharidin); principles possessing a purgative action (podophyllin, elaterin) and principles with other more or less specific effects (santonin, picrotoxin). What is known of the chemistry of these substances is given under each drug.

Many of these substances are probably secondary products which arise from easily decomposed glucosides (see elaterin).

**Oils, Fats, &c.**—The oils of the Pharmacopœia are of two kinds, *fixed* and *volatile*. They possess little in common



except their solubility in similar media and their density relative to water. Nearly all are lighter than water. Fixed oils decompose on heating, and cannot therefore be distilled. Volatile oils are obtained mainly by distillation. They can be distinguished by applying to paper; a translucent mark is produced which disappears on heating in the one case, but not in the other.

*Fixed oils and fats.*—These are mixtures of glycerol esters (so-called glycerides). When treated with a solution of caustic alkali they split up into glycerol (glycerin) and the alkali salt of certain fatty acids. This process is known as *saponification*.<sup>1</sup>

The main, almost sole, ingredients of many fixed oils and fats are the three glycerides—olein, palmitin, and stearin. Olein is glyceryl tri-oleate  $(C_{17}H_{33}COO)_3 \cdot C_3H_5$ , palmitin is glyceryl tri-palmitate  $(C_{15}H_{31}COO)_3 \cdot C_3H_5$ , stearin is glyceryl tri-stearate  $(C_{17}H_{35}COO)_3 \cdot C_3H_5$ . On the proportion of these present the consistence of the fat mainly depends. Olein is fluid; palmitin and stearin are solid at ordinary temperatures. Therefore, in the case of fluid oils, olein predominates; in the case of solid fats, palmitin and stearin.

Palmitic and stearic acids are saturated acids; oleic acid is unsaturated. To the oleic acid series belongs ricin-oleic acid (obtained from castor oil). Linoleic and other acids occurring in the so-called drying oils (linseed, hemp, &c.) are still more unsaturated. Other acids are occasionally found combined in certain other oils, but these are not of much importance.

Pure fat is practically stable. Commercial fats and oils, however, usually contain traces of free fatty acids, albuminous substances, odorous and colouring matters, and often other ingredients, and some of these are unstable, and are the means of inducing changes in the fundamental constituents of fats. The fat usually becomes somewhat firmer on account of the separation and crystallisation of the free acid, and later it assumes an unpleasant taste and smell owing to the formation of lower volatile fatty acids (butyric, valeric, caproic). This change is known as rancidity. It is probably of enzymic or bacterial origin.

The origin of oils and fats is probably similar in both the animal and vegetable kingdoms. They are widely distributed, and in both kingdoms play the part of a reserve material.

The ordinary chemical methods of determining the purity of oils and

<sup>1</sup> The term saponification is often employed to indicate hydrolysis of almost any ester.

fats (iodine absorption, saponification, &c.) are not recognised in the British Pharmacopœia and consequently need no further mention.

The fixed oils and fats are insoluble in water, and, with few exceptions, only soluble with difficulty in cold alcohol. They are readily soluble in ether, chloroform, carbon bisulphide, benzene, and similar solvents.

The taste of most is bland and 'oily.' Many possess a slight characteristic smell or taste due to the presence of traces of substances derived from the parent source. Cacao-butter (*Oleum Theobromatis*), for example, has a slight taste of cocoa. If much free fatty acid is present the taste may be somewhat acrid or unpleasant (castor oil, cod-liver oil).

They are obtained by expression or by melting and straining.

The fixed oils and fats of the Pharmacopœia are :

Vegetable	{ fluid	{ Olive oil.
		{ Almond oil.
		{ Linseed oil.
		{ Castor oil.
		{ Croton oil.
Animal	{ solid	{ Oil of theobroma.
		{ Cod liver oil.
	{ solid	{ Lard (pure and benzoated).
		{ Suet.

*Soaps*.—By saponification of the fixed oils and fats by means of metallic hydroxides soaps are formed. These are salts of oleic, palmitic, and stearic acids. Potassium and sodium soaps are moderately soluble in water, potassium soaps being the more soluble; soaps of the heavy metals are practically insoluble in water.

The following occur in the Pharmacopœia :

- Hard soap (*Sapo durus*), mainly sodium oleate.
- Soft soap (*Sapo mollis*), mainly potassium oleate.
- Curd soap (*Sapo animalis*), mainly sodium stearate.
- Lead soap (*Emplastrum Plumbi*), mainly lead oleate.

*Waxes* are allied to fats in being fatty acid esters, but they are esters of monohydric alcohols. There are two in the Pharmacopœia—

- Spermaceti (*Cetaceum*), mainly cetyl palmitate,  $C_{16}H_{31}COO \cdot C_{16}H_{33}$ .
- Beeswax (*Cera alba et flava*), mainly myricyl palmitate  $C_{16}H_{31}COO \cdot C_{30}H_{61}$ .

Vegetable waxes are for the most part glycerides. None are official in the Pharmacopœia.

*Wool fat* is also comparable to ordinary fats. It is a mixture of substances, but consists mainly of cholesterin and cholesterin esters. The latter are not easily hydrolysed, but may be broken up into the alcohols, cholesterin and iso-cholesterin, and fatty acids (mainly stearic acid).

*Volatile oils* are of two kinds: (1) essential oils; (2) mustard oils. The term volatile oil is commonly used in place of essential oil. Essential oils are transparent, colourless, or almost colourless liquids with a powerful and usually pleasant odour and an aromatic burning taste. They are slightly soluble in water (see the official aquæ), readily soluble in most organic solvents. They are inflammable, and when exposed to the air undergo oxidation and become darker and slightly acid (resinify). Most of them consist chiefly of a terpene or a mixture of terpenes. A few, *e.g.* oil of roses and oil of wintergreen (methyl salicylate, official in the Addendum), contain no terpene; and some consist mainly of phenols (oil of cloves) or of terpene alcohols or esters.

Nearly all the essential oils contain oxygenated compounds (complex alcohols, aldehydes, ketones, ethers, esters, &c.), which give to them their characteristic odour and taste and slightly modify their pharmacological action. The terpeneless essential oils which are used in perfumery consist mainly of these oxygenated compounds free from terpene. On standing some of these substances may crystallise out, forming the so-called stearoptene.

The terpenes found in drugs are mono-terpenes ( $C_{10}H_{16}$ ) and poly-terpenes ( $(C_5H_8)_n$ ). Of the latter, sesqui-terpenes ( $C_{15}H_{24}$ ) are of most importance, di-terpenes ( $C_{20}H_{32}$ ) being rare. Of the theoretically possible mono-terpenes, nearly all are found in plants. Chemically they are divided into groups according to their behaviour with bromine, nitrosyl chloride, &c.—phellandrenes do not unite with bromine, pinenes form di-bromides, and limonenes tetra-bromides: pharmacologically, however, they form one group.

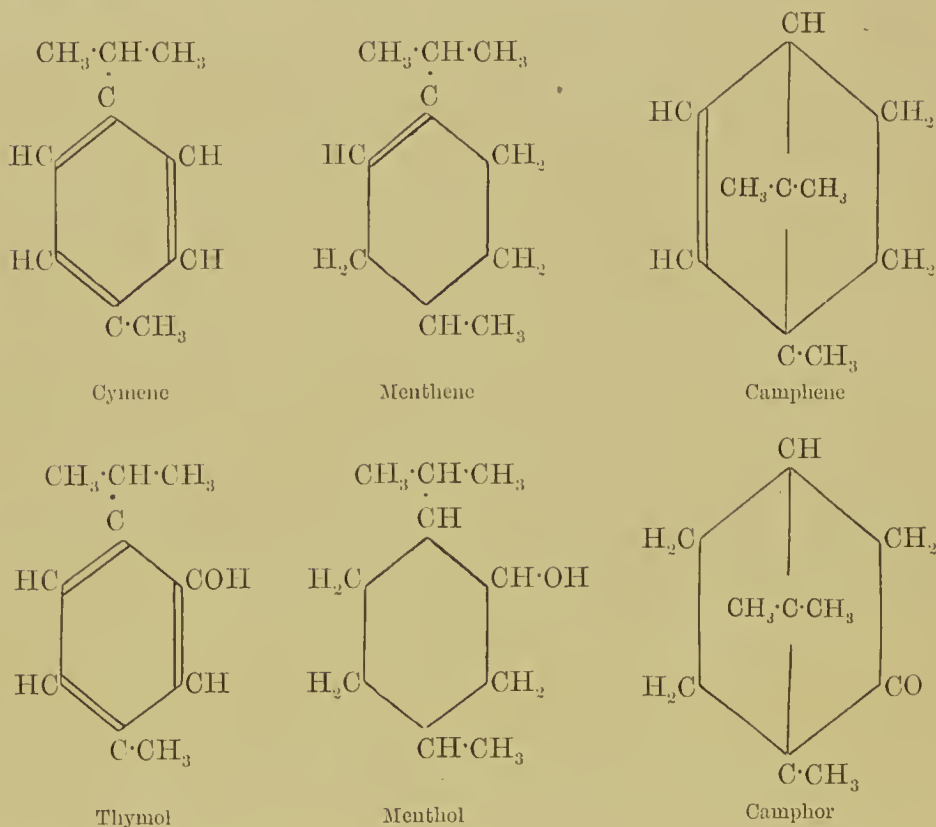
Associated with the terpenes pharmacologically is cymene ( $C_{10}H_{14}$ ), which occurs in caraway and other oils. It is para-methyl-isopropylbenzene. Into it many of the terpenes can be converted, and from it some of them can be prepared. Thymol (official) is a hydroxy-cymene.

Camphor and menthol (both official substances) are also allied to the terpenes. Camphor may be obtained by oxidising a terpene (*d*-camphene) with chromic acid. It has the empiric formula  $C_{10}H_{16}O$ , the oxygen

being ketonic. By reduction camphor yields borneol (Borneo-camphor), which is a secondary alcohol. Boiling nitric acid converts camphor into *d*-camphoric acid  $C_8H_{14}(COOH)_2$ , which is occasionally used in medicine but is not official.

Menthol (*l*-menthol), peppermint camphor, is converted on heating with sulphuric acid, or certain other substances, into menthene, and is therefore related to this. It can be prepared from menthone, the corresponding ketonic compound. It is methyl-isopropyl-hexahydrophenol.

The following formulæ indicate the relationship of some of these substances :



The odoriferous ingredient of oil of rose (geraniol) and oil of lavender (linalool) is an olefinic alcohol (see pages 504, 505). The corresponding hydrocarbons are sometimes termed open-chain, aliphatic, or olefinic terpenes.

The official essential oils are Oleum Anethi, Oleum Anisi, Oleum Anthemidis, Oleum Cajuputi, Oleum Carui, Oleum Caryophylli, Oleum Cinnamomi, Oleum Copaibæ, Oleum Coriandri, Oleum Cubebæ, Oleum Eucalypti, Oleum Juniperi, Oleum Lavandulæ, Oleum Limonis, Oleum Menthæ Piperitæ, Oleum Menthæ Viridis, Oleum Myristicæ, Oleum Pimentæ, Oleum Pini, Oleum Rosæ, Oleum Rosmarini, Oleum Terebinthinæ.

Mustard oils are iso-thiocyanates. They are yellowish liquids with a pungent odour, slightly soluble in water,



readily soluble in organic solvents. Only one—volatile oil of mustard (allyl iso-thiocyanate)—is official. It is obtained by distilling a mixture of powdered black mustard seeds and water. The seeds contain a glucoside, potassium myronate, or sinigrin, which is hydrolysed by a ferment, myrosin, also occurring in the seeds, thus :



The same decomposition occurs when horse-radish root is mixed with water.

White mustard seeds when treated in the same manner yield oil or white mustard. This consists of acrynyl iso-thiocyanate, which can be obtained in a crystalline condition, and is less pungent and volatile than allyl iso-thiocyanate.

### **Resins; Oleo-resins; Gum-resins; Balsams. —**

These are most conveniently considered together. As found in plants, resins are associated with volatile oils and gums, and are in most instances obtained as oleo-resins or gum-resins. By some authors the term resin is applied to the whole group, but it is better confined to the residue obtained after separation of the oil, gum, and impurities.

*Resins*, thus restricted, are organic substances composed of carbon, hydrogen, and relatively little oxygen, which possess, in bulk, a smooth glassy or waxy appearance, and break with a conchoidal fracture,<sup>1</sup> are insoluble in water but generally soluble in ether, chloroform, terpenes, &c., and often in alcohol, and when treated with alkalies usually form so-called resin soaps. Many of the pharmacopœial examples are mixtures of substances.

The official resins may be divided into—

(a) Those possessing comparatively little pharmacological action—*Resina*, *Guaiaci Resina*.

(b) Those possessing marked purgative properties—*Jalapæ Resina*, *Podophylli Resina*, *Scammonie Resina*.

*Oleo-resins* are natural exudations consisting of a resin and volatile oil. The proportions vary, the resin preponderating, but the oil must be present in appreciable amounts.

Those official in the *Pharmacopœia* are : *Copaiba*, *Pix Burgundica*, *Terebinthina Canadensis* (Canada balsam), *Thus Americanum* (common

<sup>1</sup> Resin of *Podophyllum* is obtained as a granular powder.



frankincense). They possess similar pharmacological properties. Copaiba is given internally and is of most importance.

*Balsams* are natural resinous exudations (resins and oleo-resins) containing benzoic and cinnamic acids, free and combined. The presence of these substances makes them more pleasantly aromatic and adds to their pharmacological effect.

The pharmacopœial examples are: Benzoinum, Balsamum Peruvianum, Balsamum Tolutanum, Styrax Præparatus. They possess similar pharmacological actions.

*Gum-resins* are natural products consisting of a mixture of gums and resins. They usually contain a small amount of volatile oil. They possess the characteristic property of forming a milky mixture (an emulsion) when triturated with water. This is due to the water dissolving the gum and forming a mucilage which suspends the finely divided particles of resin. The resin can be separated from the gum by dissolving it in alcohol, in which gum is insoluble.

The pharmacopœial examples are: Ammoniacum, Asafetida, Myrrha, Cambogia, Scammonium. The last two have a powerful purgative action.

The resins, oleo-resins, &c., differ in appearance, taste, smell, and other properties. In most cases these are sufficiently characteristic to render their detection easy. The form varies according to the manner of collecting; occasionally to subsequent operations. Gamboge, for example, is poured into bamboos and allowed to solidify: hence it has a striated appearance and a cylindrical form (see fig. 114). Scammonium, again, after being collected in shells, is allowed to undergo fermentation, and consequently assumes a porous character somewhat resembling a cinder (see fig. 50). Other resins, and especially gum-resins, occur in what is known as the 'tear' variety and the 'lump' form. Tears are round or nodular masses of apparently homogeneous structure, generally translucent or milky white internally and more or less brown externally (see fig. 113). They vary in size, and may occur individually or united into masses. The lump form consists of nodules imbedded in a brownish matrix, which also often contains pieces of bark and other impurities (see fig. 115). It is only allowed by the Pharmacopœia when the nodular variety for certain reasons cannot be obtained.

The genesis of oils and resins is not definitely known. They appear to be formed in most cases in special secretory ducts which occur both in the bark and wood, and which sometimes break down to form so-called lysigenous cavities. The volatile oils themselves, however, probably originate in the leaves, and migrate to other portions of the plant—the bark, wood, and flowers. They form the mother substance from which one variety of resins and oleo-resins—the terpene-resins—arises.

Normally, resins are formed only in small amounts, but after injury to the bark or tissue, whereby an exit is opened and a pathological condition produced, they are formed in much larger quantity. Some resinous substances—*e.g.* storax—are pure pathological products. The terpene-resins (mainly obtained from coniferous trees) probably arise, as stated, from volatile oils; other resins, however, seem to originate, in part at least, from tannic acid, phloroglucin, and similar substances. The former consist mainly of free acids—the resin acids; the latter of esters—compounds of aromatic acids with so-called resin alcohols. They may be divided on this basis into:

(1) Resins consisting of so-called resin-acids (resinolic acids) and containing no esters. They are very stable compounds. They probably arise from volatile oils, and are usually found in combination with these as oleo-resins. Pharmacopœial examples—Resina; the resins of the official oleo-resins.

(2) Resins which are essentially esters of so-called resin-alcohols and aromatic acids. They may or may not contain free acid. They are probably derived from tannic acid and allied substances. Examples—The balsams, and certain gum-resins (*Ammoniacum*, *Asafetida*, *Galbanum*).

(3) A third group of resin-glucosides or gluco-resins may be added. Examples—convolvulin and scammonin in *Jalapæ Resina*, &c.

(1) The type of the acids found in the first group is abietic acid, occurring in ordinary resin. It is a white crystalline substance, soluble in hot alcohol and also in solutions of caustic alkalies (see page 515).

(2) The so-called resin-alcohols (*Tschirsch*) are divided into two groups—(a) resinols, which are colourless and give no tannin reaction; (b) resino-tannols, which are coloured and give a tannin reaction. They occur combined with benzoic, cinnamic, and other aromatic acids in the gum-resins and balsams (see pages 525 to 528, and 531).

(3) The feature of this group is its glucosidal nature. Besides a sugar, its members yield complex acids which in most cases have a powerful pharmacological action (see page 381).

[Some very stable substances, known as resenes, have also been obtained from certain resins (*myrrh* and unofficial resins). Their stability suggests that they are of no pharmacological importance.]

**Gums** are amorphous translucent carbohydrates  $(C_6H_{10}O_5)_n$  which dissolve or swell up in water to form an adhesive mixture possessing a characteristic, usually bland taste, and yielding on hydrolysis sugars of the pentose and hexose types. They are insoluble in alcohol, ether, and most organic solvents. They are generally regarded as being composed of one or more of three different substances: (a) *Arabin*, which is soluble in water and therefore forms the chief ingredient of the soluble gums; (b) *Bassorin* (*tragacanthin*), which is

partially soluble and swells up in water ; (c) Cerasin, which is insoluble in water.

The official gums are—*Acaciæ Gummi*, which consists mainly of arabin ; and *Tragacantha*, consisting mainly of bassorin.

Gums are widely diffused in the vegetable kingdom. They appear to originate in a chemical metamorphosis (gummosis) of tissues, more especially the cell-wall, but why this occurs is not known. Recent observations seem to show that it is of bacterial origin.

The gum in small quantities often finds an exit through openings in the bark, but in the case of commercial gums the bark of the gum-yielding trees is artificially cut or punctured. The gummy tissue then swells, and the gum is extruded and gradually dries. The form of the gum naturally varies with the manner in which the operation has been performed. If simple puncture has been done, the gum occurs as small rounded masses or tears—*e.g.* gum *acacia* (fig. 117) ; if the opening is a slit, the gum assumes a flaky or ribbon-like character, as in *tragacanth* (fig. 118).

The chemistry of gums, so far as it is known, is not of much practical importance. Arabin appears to consist of the calcium, potassium, and magnesium salts of arabic acid (chiefly the acid calcium salt)—an acid which, on hydrolysis, yields arabinose, galactose, and isogallic acid. Cerasin yields arabinose, and is also a calcium salt. Bassorin is not a salt, but yields the same sugars as arabin and cerasin.

**Tannins.**—These are common constituents of plants. They are a somewhat ill-defined group of substances, characterised by being soluble in water, precipitating albuminous and gelatinous solutions and forming a bluish or greenish colour with solutions of ferric salts. They have a strong astringent taste, and convert raw hide into leather. They are of interest to the physician mainly on account of the incompatibilities to which they give rise, more especially with iron salts. They are also an occasional cause of indigestion, as in excessive tea-drinking.

The tannins may result from the normal metabolism of the plant, or may be pathological products (galls). Many of the former exist in the plant as glucosides ; the latter commonly exist free. Ordinary tannic acid is probably the anhydride of di-gallic acid (see page 413). Several classifications of the tannins have been suggested, but that of Trimble, according to their reaction with ferric salts, although unsatisfactory, is perhaps the best. He divided them into (i) the gallo-tannic acid group, which gives a blue colour with ferric salts and contains common tannic acid (*Aeidum Tanniennum*), the tannin of pomegranate bark, &c. ; (ii) the oak-tannin group, giving a greenish colour with ferric salts and containing the tannins of catechu, kino, krameria, cinchona, &c. The various



tannins are distinguished by prefixing the name of the plant or drug from which each is derived: thus, gallo-tannic acid, catechu-tannic acid, kino-tannic acid, &c.

The function of tannin in the vegetable metabolism is unknown. It mainly occurs dissolved in the cell-sap, and is not in all cases a simple excretory product. It has certainly a protective influence in some instances, preventing by its taste the depredations of animals.

**Organic acids.**—These, free or combined, are very common constituents of plants. The most frequently occurring are citric, tartaric, and malic acids, but in many plants and especially in drugs special acids exist. Thus meconic acid occurs in opium, quinic acid in cinchona bark, &c. Tartaric and citric acids (both official) are of most importance.

**Colouring matters.**—These are widely distributed, but are of little pharmacological or pharmaceutical importance except in a few cases. Chlorophyll is specially retained in the so-called green extracts, and certain substances (red sanders wood, red poppy petals, cochineal) are official mainly on account of their colouring properties. A point of practical importance is the different colour reaction obtained in acid and alkaline solutions with many of these colouring agents.

**Ferments.**—These play an important part in vital phenomena both animal and vegetable, but a comparatively unimportant one in therapeutics. Pepsin and pancreatin (*Liquor Pancreatis*), both animal products, are official in the British Pharmacopœia, and vegetable ferments (papayotin, diastase) are occasionally used. The decomposition of glucosides by means of ferments has been referred to.

Other vegetable and animal products only need mention. They include proteids, starches, sugars, cellulose, and allied substances, and metallic salts which after combustion remain as 'mineral ash.' These are undesirable constituents from a medicinal point of view,<sup>1</sup> and are therefore to be avoided in making preparations. For the most part they are insoluble in alcohol, hence the large number of alcoholic preparations in the Pharmacopœias.

<sup>1</sup> Preparations of the thyroid gland are exceptions, since the active ingredient is a proteid substance containing iodine.

## PHARMACOPŒIAL PREPARATIONS

CRUDE animal and vegetable substances are ill-adapted for administration in disease; hence the necessity for so-called 'preparations,' in which an attempt is made to obtain the active ingredients in a suitable form. In most cases these are of the nature of extracts, the solvent and process varying according to requirements and the active principles of the drug. The solvent is generally water or alcohol or a mixture of the two, but ether, acetic acid, glycerin, and other substances are also employed. The product may be inspissated or diluted. Other preparations, especially those of pure and powerful drugs, and so-called compound preparations, are mainly for the convenience of the physician; others, again, *e.g.* lozenges, are often for the convenience of the patient.

There is usually more than one preparation of a drug. (a) The drug may be useful in a variety of conditions which may need different modes of application; for external diseases, ointments, liniments, plasters, &c., are necessary; for internal diseases, such preparations as infusions and tinctures. (b) A varying rapidity of action may be required; for a rapid effect a solution which can be injected under the skin is needed; for a slow and prolonged effect, a preparation such as a pill or powder. (c) Different combinations are frequently required; thus there is both an alkaline and an acid solution of arsenic official, for combination with alkaline or acid preparations, or substances incompatible with one or other of these. (d) The convenience of the physician and patient must be studied: the former is attained by compound preparations, the latter by convenient modes of administration.

The **processes** employed in the Pharmacopœia and in pharmacy generally are similar to those employed in chemistry, and need not be described. A few, more peculiar to pharmacy, alone require mention.



*Maceration*.—A process used in making tinctures and a few other preparations. It consists in soaking the drug, usually powdered, in the proper quantity of menstruum, for seven days, frequently agitating; straining; pressing the residue (the 'marc'); mixing the two liquids, and filtering if necessary.

*Percolation*.—A process also used mainly in making tinctures. It consists in first moistening the powdered drug with the solvent, allowing it to stand twenty-four hours to swell, and afterwards packing it in a pear-shaped or cylindrical vessel known as a percolator. More of the solvent is then poured on from time to time, a layer of liquid being maintained above the drug until the operation is finished, and the fluid percolating through is collected. The marc is pressed, the expressed fluid is filtered if necessary and added to the percolate. Sufficient menstruum is then added to make the liquid of proper bulk. (For details, see B.P., Appendix viii.)

*Granulation* is a term applied to the process by which certain substances or mixtures of substances are obtained in small irregular pieces. In some cases it consists in pouring the melted substance or the substance in solution into a liquid in which it is not soluble, but in the Pharmacopœia it is confined to the making of effervescing preparations, and consists in pressing the slightly moist and warmed mixture through sieves of appropriate size and carefully drying (see page 103).

*Scaling* is a process by which certain non-crystallisable substances are obtained in the form of thin scales. A thin layer of the syrupy solution is allowed to evaporate, at a moderate temperature, on sheets of glass, and is scraped off when dry. The process is confined in the Pharmacopœia to three preparations of iron (see page 176).

The *pulverisation* of drugs, especially vegetable drugs, is necessary for making most of their preparations. It is usually done on a large scale by means of drug mills. On a small scale it may be accomplished, although less satisfactorily, by pounding the drug in an iron or brass mortar. In the case of most vegetable tinctures the size of the particles is specified by the Pharmacopœia. Thus, No. 20 means particles that will pass through a sieve having twenty wires, but not through a sieve having thirty wires to the linear inch.

Non-fibrous substances can generally be brought to a state of fine division by simple trituration in a mortar. Occasionally it is necessary to add a liquid, which is subsequently got rid of, to reach this end—a process known as *levigation*. Another process for obtaining certain inorganic substances insoluble in water (*e.g.* prepared chalk) in a state of fine division is *elutriation*. This consists in suspending the powdered substance in water, allowing the heavier particles to subside, decanting, and then letting the finer particles settle. The pasty mass is afterwards dried.

The **weights and measures** of the British Pharmacopœia are the Imperial weights and measures in common

use in this country. The metric system, however, is permitted.

The following classes of preparations are recognised by the British Pharmacopœia.

**Aceta**—vinegars. Solutions of the active principles of drugs in acetic acid of various strengths.

Three are official :

	Mode of Preparation	Strength <sup>1</sup>	Dose
<b>Acetum Cantharidis</b> .	{ Maceration and percolation }	1 in 10	{ Not given internally
<b>Acetum Ipecacuanhæ</b> .	{ Dilute the liquid extract }	0·1 per cent. alkaloids	10-30 minims
<b>Acetum Scillæ</b> .	Maceration	1 in 8	{ 10-30 minims

**Aquæ** — waters. These include distilled water and weak solutions of a volatile substance in distilled water. Nearly all are simple solutions of volatile oils and are used mainly as flavouring agents.

They are prepared by distilling (*a*) part of a plant, or (*b*) a volatile oil with water, or (*c*) by simple solution. A fourth method—trituration of the oil with twice its weight of calcium phosphate, diffusing in five hundred times its volume of distilled water, and filtering—is permitted in India and tropical colonies.

(*a*) 1 lb. of the drug is usually added to 2 gallons of water and 1 gallon distilled.

**Aqua Anethi**, **Aqua Anisi**, **Aqua Carui**, **Aqua Cinnamomi**, **Aqua Fœniculi** are prepared in this way. **Aqua Pimentæ** is prepared with half the quantity of drug (8 oz.) ; **Aqua Sambuci** by adding 5 gallons of water to 10 lbs. of drug and distilling 1 gallon.

**Aqua Laurocerasi** is peculiar both in its preparation and dose. Two and a half pints of water are added to 1 lb. of drug and *one pint* distilled. It is standardised (see page 21).

**Aqua Aurantii Floris** and **Aqua Rosæ** are made by diluting commercial orange-flower water or rose water with twice the volume of distilled water.

(*b*) **Aqua Menthæ Piperitæ** and **Aqua Menthæ Viridis** are prepared by adding 77 minims of the oil to  $1\frac{1}{2}$  gallons of water and distilling 1 gallon. They are 1 in 1,000 solutions.

<sup>1</sup> Throughout this work, 1 in 5, 1 in 10, 1 in 100, &c., means 1 part (by weight, if solid) of pure or crude drug, as the case may be, in 5, 10, or 100 parts (volumes, if liquid) respectively of finished product.

(c) **Aquæ Camphoræ** is a 1 in 1,000 solution of camphor in distilled water. **Aqua Chloroformi** is a 1 in 400 solution of chloroform in distilled water.

No official dose of the aquæ is given except for **Aqua Laurocerasi** (standardised to contain 0·1 per cent. hydrocyanic acid) which is 1 to 2 *drachms*. The rest are comparatively innocuous and may be given in doses of 1 to 2 fluid ounces.

**Charta**—a paper. Consists of an active ingredient mixed with solution of indiarubber and spread upon cartridge paper.

Only one—**Charta Sinapis**—is official.

**Collodia**—collodions. Solutions of pyroxylin in ethereal liquids.

Three are official :

**Collodium** (pyroxylin, 1 ; ether, 36 ; alcohol, 12).

**Collodium Flexile** (collodion, 12 ; Canada turpentine,  $\frac{1}{2}$  ; castor oil,  $\frac{1}{4}$ ).

**Collodium Vesicans** (pyroxylin, 1 ; blistering fluid, 40).

**Confectiones**—conserves, electuaries, boluses. Sweet pasty masses consisting of drugs, generally in a dry form, mixed with syrup, sugar, or honey.

Four are official :

**Confectio Rosæ Gallicæ** (fresh red-rose petals, 1 ; sugar, 3).

**Confectio Piperis** (black pepper, 2 ; caraway fruit, 3 ; honey, 15).

**Confectio Sennæ** (1 in 11 of senna with laxative fruits [figs, tamarinds, prunes, cassia pulp], and flavouring and carminative ingredients [coriander fruit, extract of liquorice], massed with sugar and water).

**Confectio Sulphuris** (contains nearly half—4 in 9—of sublimed sulphur).

Dose of all, 60 to 120 grains ; except **Confectio Rosæ Gallicæ** which has no dose. It is used only as a pill excipient.

**Decocta**—decoctions. Solutions made by boiling a vegetable drug (in one case an extract) in water in a closed vessel for 5 to 10 minutes, straining and adding water. They are impure solutions consisting of non-volatile active principles.

Three are official, one being compound :

**Decoctum Granati Radicis**, 4 in 20.

**Decoctum Hæmatoxyli**, 1 in 20 (contains a little cinnamon-bark).

**Decoctum Aloes Compositum**, 1 in 100 of extract of Barbados aloes. It is a complex preparation (see page 408).

Dose of all,  $\frac{1}{2}$  to 2 fluid ounces.

**Emplastra**—plasters. Solid adhesive substances becoming soft and pliable at the temperature of the body. (Emplastrum Cantharidis, the common blister, is soft at ordinary temperatures and is not distinctly adhesive.) Plasters are usually spread on calico or leather prior to use. They are employed mainly for their local effect, but in the case of mercury and belladonna plasters a general action is obtained.

There are twelve official. Eight contain lead plaster, and this forms the actual basis, directly or indirectly, of seven. This is seen in the following table :

Emplastrum Plumbi	{	Empl. Hydrargyri	{	Empl. Belladonnæ
		Empl. Plumbi Iodidi		Empl. Opii
		Empl. Resinæ		Empl. Calefaciens
		Empl. Saponis		

→

**Emplastrum Cantharidis** contains soap plaster, but its basis is a mixture of resin, lard, and wax (cantharides,  $3\frac{1}{2}$ ; yellow beeswax, 2; lard, 2; resin, 2; soap plaster,  $\frac{1}{2}$ ). **Emplastrum Calefaciens** contains a little resin and wax besides the two plasters.

**Emplastrum Menthol** has a resin basis (menthol,  $1\frac{1}{2}$ ; yellow beeswax, 1; resin,  $7\frac{1}{2}$ ).

**Emplastrum Ammoniaci cum Hydrargyro** has an ammoniacum basis.

**Emplastrum Picis** consists almost wholly of resin and oleo-resins.

**Extracta**—extracts. Concentrated preparations of vegetable drugs of a syrupy consistence (liquid extracts) or of a thick, tenacious, sometimes dry consistence (ordinary extracts).

The latter are prepared by evaporating (*a*) the expressed juice of a plant; or (*b*) solutions of its constituents in suitable media.

The details of the process vary in different cases. In one (*Strophanthus*) the drug is first percolated with ether to remove oil; in others



certain substances are used to aid or prevent solution of ingredients; others again are diluted with sugar of milk after evaporation, and to one (*Extractum Euonymi Siccum*) calcium phosphate is added to keep it in a dry state.

There are twenty-two extracts in the *Pharmacopœia*. They may be divided into the following varieties:

### Inspissated Juices.

**Fresh Extracts.**—The juice crushed from the fresh drug is allowed to stand until the feculence has subsided. The liquid is then raised to 100°C. to coagulate the albumen, which is strained off, and the strained liquor is evaporated to proper consistence at a temperature of about 71°C.

Those official are *Extractum Colchici* and *Extractum Taraxaci*.

**Green Extracts.**—These are a variety of fresh extracts, a modification being introduced to retain the chlorophyll which is believed to improve the appearance. The liquid of the juice is heated to 54.4°C. to coagulate the chlorophyll, which is filtered off. The liquid is then heated to 93.3°C. and filtered. The filtrate is reduced to a thin syrup on the water-bath, and after the colouring matter, previously passed through a hair sieve, has been added, the whole is evaporated to the consistence of a soft extract at a temperature not exceeding 60°C.

*Extractum Belladonnæ Viride* and *Extractum Hyoscyami Viride* are the only examples in the *Pharmacopœia*.

**Aqueous Extracts.**—These are prepared by macerating or boiling the drug in water, straining, and evaporating the liquid to a proper consistence.

Those in the B.P. are—*Extractum Aloes Barbadosis*; *Extractum Anthemidis*; *Extractum Cascaræ Sagradæ*; *Extractum Gentianæ*; *Extractum Glycyrrhizæ*; *Extractum Kramerizæ*; *Extractum Opii*.

**Alcoholic Extracts.**—Prepared by macerating or percolating the drug with alcohol (or alcohol and water) and evaporating to a soft consistence, to dryness, or until proper consistence can be obtained by the addition of sufficient milk sugar.

The following occur in the B.P.:—*Extractum Cannabis Indicæ*; *Extractum Colchici Compositum*; *Extractum Ergotæ*; *Extractum Jalapæ*; *Extractum Physostigmatis*; *Extractum Rhei*; *Extractum Stramonii*; *Extractum Strophanthi*.

In preparing the last-named extract the powdered seeds of *Strophanthus* are first percolated with ether to remove oil. In the case of extract of jalap, the jalap is first treated with alcohol and afterwards with water.

*Extractum Ergotæ* has a complex mode of preparation. The powdered ergot is percolated with 60 per cent. alcohol, and the percolate evaporated to a given bulk. Water is added, and the



mixture filtered when cold. The filtrate is treated with dilute hydrochloric acid to remove resinous matter, and, after filtering, the filtrate is neutralised with sodium carbonate and evaporated.

In two cases the solid extract is prepared by evaporating the official liquid extract and adding milk sugar, viz. **Extractum Nucis Vomicae** and **Extractum Belladonnae Alcoholicum**.

The varieties of extracts are often unnecessarily increased by the addition of so-called *dry* and *ethereal* extracts. One extract in the Pharmacopœia is termed dry, viz. **Extractum Euonymi Siccum**. It is an alcoholic extract which is evaporated to dryness and afterwards powdered. As it is somewhat hygroscopic in this form, one-quarter its weight of calcium phosphate is added, and the mixture further dried and powdered until a satisfactory preparation is obtained.

There is also one ethereal extract—**Extractum Filicis Liquidum**—which is obtained by percolating the drug (powdered male fern rhizome) with ether and evaporating off the ether. This extract differs from other liquid extracts in retaining none of the solvent.

One of the ordinary extracts—**Extractum Colocynthis Compositum**—is a compound extract. Besides an alcoholic extract obtained from Colocynth Pulp, it contains Extract of Barbados Aloes, Scammony Resin, and other ingredients.

*Liquid Extracts.*—These are impure concentrated solutions of the active principles of vegetable drugs (except **Extractum Filicis Liquidum**, which is not a solution). They are of a thin syrupy consistence, and are generally made so that one fluid ounce represents one ounce of crude drug. The exceptions are the standardised preparations—**Extractum Belladonnae Liquidum** (contains 0.75 g. total alkaloids in 100 c.c.), and **Extractum Nucis Vomicae Liquidum** (contains 1.5 g. strychnine in 100 c.c.)

The general method of preparing liquid extracts is to macerate, then percolate, the coarsely powdered drug with water (*Cascara Sagrada*, *Ergot*, *Liquorice*), acidulated water (*Cinchona*), or alcohol of various strengths, and afterwards evaporate the whole, or more usually the last portions of the percolate, or repercolate (*Belladonna*, *Sarsaparilla*), and make up to a given bulk with alcohol or alcohol and water.

The deviations from this method are few and comparatively unimportant. **Extractum Opii Liquidum** is made from the solid extract. **Extractum Pareiræ Liquidum** is made by percolating the drug with boiling water to ten times its weight, then evaporating until the product contains one-third its weight of extractive matter, and finally adding sufficient alcohol to produce, from three volumes of evaporated liquid, four volumes of liquid extract. (This extract is of little importance.)

In India and the Colonies the quantity of alcohol (90 per cent.) may be increased to one quarter the weight of the liquid extract if it falls short of this amount in the official description.

The extracts may also be classified according to their doses.

SOLID EXTRACTS		LIQUID EXTRACTS	
	Dose		Dose
Extractum Belladonnæ		Extractum Belladonnæ	
Alcoholicum		Liquidum	none given <sup>1</sup>
— Belladonnæ Viride	} $\frac{1}{4}$ –1 grain	— Ipecacuanhæ Liq.	$\frac{1}{2}$ –2 min.
— Cannabis Indicæ		— Nucis Vomicæ Liq.	1–3 min.
— Colchici		— Cinchonæ Liq.	} 5–15 min.
— Nucis Vomicæ		— Hamamelidis Liq.	
— Opii		— Hydrastis Liq.	
— Physostigmatis		— Jaborandi Liq.	} 5–30 min.
— Stramonii		— Cimicifugæ Liq.	
— Strophanthi		— Opii Liq.	
— Euonymi Siccum	1–2 grains	— Ergotæ Liq.	10–30 min.
— Aloes Barbadosis	1–4 grains	— Cascaræ Sagradæ	} 30–60 min.
— Anthemidis	} 2–8 grains	— Cocæ Liq.	
— Cascaræ Sagradæ		— Glycyrrhizæ Liq.	
— Colocyntidis Co.		— Filicis Liq.	45–90 min.
— Ergotæ		— Pareiræ Liq.	} 30–120 min.
— Gentianæ		— Taraxaci Liq.	
— Hyoscyami Viride		— Sarsæ Liq.	2–4 fl. drachms
— Jalapæ	} 5–15 grains		
— Rhei			
— Krameriæ			
— Taraxaci			
— Glycyrrhizæ	none given <sup>1</sup>		

<sup>1</sup> Extractum Belladonnæ Liquidum is mainly used for making other belladonna preparations. It might be given in doses of  $\frac{1}{2}$ –1 minim. Extractum Glycyrrhizæ is innocuous.

**Glycerina**—glycerins or glyceroles. Mixtures or solutions of substances in glycerin or glycerin and water. Most are prepared by simple trituration.

(a) Solutions :	Strength
Glycerinum Acidi Carbolici . . .	1 in 5
— Acidi Tannici . . .	1 in 5
— Aluminis . . .	1 in 6 (contains $\frac{1}{16}$ water)
— Boracis . . .	1 in 6
— Pepsini . . . 5 grains in 1 drachm.	Dose: 1–2 drachms
— Plumbi Subacetatis . . .	(see page 158)

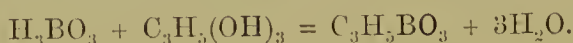
(b) Semi-solid mixtures :

	Strength
<b>Glycerinum Tragacanthæ</b> . . . . .	1 in 5
(Tragacanth, $\frac{1}{2}$ ; glycerin, $1\frac{1}{2}$ ; water, $\frac{1}{2}$ .)	
— <b>Amyli</b> . . . . .	1 in 9
(Starch, 1 ; glycerin, $6\frac{1}{2}$ ; water, $1\frac{1}{2}$ . Heat until the mixture becomes a translucent jelly.)	

(c) Chemical compound :

<b>Glycerinum Acidi Borici</b> . . . . .	1 in $3\frac{1}{3}$
(Boric acid 6 oz. is added gradually to 9 oz. of glycerin heated to 150°C. The heat is continued until the product is reduced to 10 oz. Then 10 oz. of glycerin are added.)	

During the heating of the boric acid and glycerin a chemical action occurs and glyceryl borate is formed.



On dissolving in water the reverse reaction occurs and boric acid is re-formed. Glycerinum Boracis and Mel Boracis undergo to some extent a similar change.

It will be noticed that **Glycerinum Pepsini** is the only one which has a dose. The rest are used as local applications.

**Infusa**—infusions. Solutions made by pouring boiling water (in two cases cold water) on a drug, allowing it to macerate (infuse) for fifteen minutes (in a few cases longer) in a closed vessel, then straining.

The drugs contain mainly bitter, aromatic, and astringent principles, and the infusions are almost solely used as excipients.

Most infusions are simple, two are compound, two are acid. In nearly all cases 1 pint of boiling water is poured on 1 oz. of bruised or powdered drug ; in the case of senna it is 2 oz. (and 55 grains of ginger), of cloves  $\frac{1}{2}$  oz. and of **digitalis** 60 grains.

**Infusum Calumbæ** and **Infusum Quassiae** are made with *cold water* ; the former because it contains a large proportion of starch which would be extracted by boiling water and would interfere with its keeping qualities and spoil its appearance ; the latter because the necessary amount of bitter active principle is readily soluble in cold, and there is no advantage in using hot water. One pint of infusion of quassia is made from 88 grains of drug.

The acid in the case of **Infusum Cinchonæ Acidum** is mainly to extract the alkaloids of the cinchona bark ; in the case of **Infusum Rosæ Acidum** it is to give the infusion a brighter red appearance.

The infusions should be made fresh as required. Only in this way can the full aromatic flavour of many of them be obtained.

The dose of nearly all the infusions is  $\frac{1}{2}$ –1 fl. oz. ; in a few it is 1–2 fl. oz. *Exception* : **Infusum Digitalis** has a dose of 2–4 fl. drachms.

The following table gives all the necessary information regarding the infusions. Twenty-two are official :

SIMPLE			COMPOUND		
	Amount in 1 Pint	Time Infused		Amount in 1 Pint	Time Infused
<b>Dose : 2–4 fl. dr.</b>			<b>Dose : <math>\frac{1}{2}</math>–1 fl. oz.</b>		
Infusum Digitalis	60 gr.	15 min.	Infusum Aurantii		
			Compositum—		
<b>Dose : <math>\frac{1}{2}</math>–1 fl. oz.</b>			Orange-peel . . .	$\frac{1}{2}$ oz.	} 15 min.
Infusum Aurantii	1 oz.	15 min.	Lemon-peel . . .	$\frac{1}{4}$ oz.	
— Caryophylli . . .	$\frac{1}{2}$ oz.	15 min.	Cloves . . .	55 gr.	
— Cascarillæ . . .	1 oz.	15 min.	Infusum Gentianæ		
— Chirettæ . . .	1 oz.	15 min.	Compositum—		
— Krameriæ . . .	1 oz.	15 min.	Gentian-root . . .	$\frac{1}{4}$ oz.	} 15 min.
— Rhei . . .	1 oz.	15 min.	Orange-peel . . .	$\frac{1}{4}$ oz.	
— Senegæ . . .	1 oz.	30 min.	Lemon-peel . . .	$\frac{1}{2}$ oz.	
— Sennæ . . .	2 oz.	15 min.			
(Ginger, 55 gr.)			(Note Infusum Sennæ.)		
— Serpentariæ . . .	1 oz.	15 min.			
— Uvæ Ursi . . .	1 oz.	15 min.			
Cold water is					
used for—					
Infusum Calumbæ	1 oz.	30 min.			
— Quassiæ . . .	88 gr.	15 min.			
<b>Dose : 1–2 fl. oz.</b>					
Infusum Buchu . . .	1 oz.	15 min.			
— Cuspariæ . . .	1 oz.	15 min.			
— Ergotæ . . .	1 oz.	15 min.			
— Lupuli . . .	1 oz.	15 min.			
— Scoparii . . .	1 oz.	15 min.			

**Injectiones** — hypodermic injections. Aqueous solutions adapted for injection under the skin. They are comparatively strong, since their dose must of necessity be small. They do not keep well. In all cases the Pharmacopœia recommends boiled distilled water to be used in their



preparation (to avoid the spores of fungi or moulds which interfere with the keeping properties of the solution, and to diminish the risk of infection by pathogenic micro-organisms), and in two cases (cocaine, ergot) a little preservative is added to aid in keeping them. A little acid is added to one (apomorphine) to help the solution of the alkaloidal salt.

Four are official :

	Strength	Dose
Injectio Apomorphinæ Hypodermica . . . . .	{ 1 per cent. of apomorphine hydrochloride }	5-10 minims
— Morphinæ Hypodermica . . . . .	{ 5 per cent. of morphine tartrate }	2-5 minims
— Cocainæ Hypodermica . . . . .	{ 10 per cent. of cocaine hydrochloride }	2-5 minims
— Ergotæ Hypodermica . . . . .	{ 33 per cent. of extract of ergot }	3-10 minims

The apomorphine injection contains rather less than 1 per cent. hydrochloric acid; the cocaine injection contains 0.15 per cent. salicylic acid; the ergot injection 1 per cent. phenol.

**Lamellæ.**—Small discs made of gelatin and glycerin containing a small amount of an alkaloid. They are used for applying to the eye.

Four are official :

	Weight	Each contains
Lamella Atropinæ . . . . .	$\frac{1}{50}$ gr.	$\frac{1}{5000}$ gr. atropine sulphate
— Physostigminæ . . . . .	$\frac{1}{50}$ gr.	$\frac{1}{1000}$ gr. physostigmine sulphate
— Homatropinæ . . . . .	$\frac{1}{50}$ gr.	$\frac{1}{100}$ gr. homatropine hydrobromide
— Cocainæ . . . . .	$\frac{1}{50}$ gr.	$\frac{1}{50}$ gr. cocaine hydrochloride

**Linimenta**—liniments. Fluid preparations suitable for external application by friction. (Linimentum Calcis is applied on lint; Linimentum Aconiti is often painted on; Linimentum Potassii Iodidi is of pasty consistence.)

There are fifteen in the British Pharmacopœia. They are perhaps best classified, for a medical student's purpose, according to their pharmacological action.

#### Sedative

Linimentum Calcis (solution of lime, 1; olive oil, 1).

**Stimulating** (in order of activity : the mildest first)—

**Linimentum Potassii Iodidi cum Sapone.** Very mild action. (Curd soap, 2; potassium iodide,  $1\frac{1}{2}$ ; glycerin, 1; oil of lemon,  $\frac{1}{8}$ ; distilled water, 10.)

— **Camphoræ** (camphor, 1; olive oil, 4).

— **Ammoniaæ** (solution of ammonia, 1; almond oil, 1; olive oil, 2).

— **Saponis** (camphor, 1; soft soap, 2; oil of rosemary,  $\frac{3}{8}$ ; alcohol, 16; water, 4).

— **Camphoræ Ammoniata** (camphor,  $2\frac{1}{2}$ ; strong solution of ammonia, 5; oil of lavender,  $\frac{1}{8}$ ; alcohol, to make 20).

— **Terebinthinæ** (oil of turpentine, 13; camphor, 1; soft soap,  $1\frac{1}{2}$ ; distilled water, to make 20).

— **Terebinthinæ Aceticum** (oil of turpentine, 4; glacial acetic acid, 1; liniment of camphor, 4).

— **Sinapis** (volatile oil of mustard, 2; camphor, 3; castor oil, 7; alcohol, 43).

— **Crotonis** (croton oil, 1; oil of cajuput,  $3\frac{1}{2}$ ; alcohol,  $3\frac{1}{2}$ ).

**Stimulating, then Sedative**—

**Linimentum Opii** (tincture of opium, 1; soap liniment, 1).

— **Chloroformi** (chloroform, 1; camphor liniment, 1).

**Liniments with Special Actions.**—The first two are powerfully poisonous.

**Linimentum Aconiti** (aconite root, 2; camphor,  $\frac{1}{10}$ ; alcohol, to make 3).

— **Belladonnæ** (liquid extract of belladonna, 10; camphor, 1; water, 2; alcohol, to make 20).

— **Hydrargyri** (ointment of mercury, 1 oz.; strong solution of ammonia, 160 minims; camphor liniment, to make 3 oz.).

**Liquores**—liquors (concentrated liquors excluded, see below). Solutions of, in most cases, definite chemical substances in water, alcohol, or in a mixture of the two.

Six liquors—**Liquor Caoutchouc**, **Liquor Epispasticus**, **Liquor Hamamelidis**, **Liquor Picis Carbonis**, **Liquor Pancreatis**, **Liquor Thyroidei**—are exceptions, being preparations of crude substances. In the case of **Liquor Caoutchouc** and **Liquor Epispasticus** special solvent media are employed—a mixture of benzol and carbon bisulphide for the former, and acetic ether for the latter. In a few instances acid, sugar, or other substance, is used to aid solution of ingredients or to preserve the liquors.

There are forty-three official. They include examples of such different substances that it is almost impossible to classify them. They are mainly, however, solutions of powerful drugs or of substances unstable or gaseous in the pure form. Some are for external use; a few are used in making other preparations; most are for internal use.

The following strengths and doses are important :

	Strength	Dose
Liquor Atropinæ Sulphatis .	1 per cent.	$\frac{1}{2}$ –1 minim
— Trinitrini . . . .	1 per cent.	$\frac{1}{2}$ –2 minims
— Arsenicalis . . . .	1 per cent.	2–8 minims
— Arsenici Hydrochloricus .		
— Sodii Arsenatis . . .		
— Strychninæ Hydrochloridi		
— Ferri Acetatis . . . .		
— Ferri Perchloridi . . .	1 per cent.	5–15 minims
— Ferri Pernitratis . . .		
— Thyroidei . . . . .		
— Arsenii et Hydrargyri Iodidi . . . .		
	{ 1 per cent. of each iodide }	5–20 minims
— Sodæ Chlorinatæ . . .	{ $2\frac{1}{2}$ per cent. available chlorine }	10–20 minims
— Potassæ . . . . .		10–30 minims
— Morphinæ Acetatis . . .	1 per cent.	10–60 minims
— Morphinæ Hydrochloridi .		
— Morphinæ Tartratis . .		
— Calcis Saccharatus . .		
	{ nearly 2 per cent. CaO }	20–60 minims
— Ethyl Nitritis . . . .	3 per cent.	
— Bismuthi et Ammonii Citratis . . . .	{ equivalent of 5 per cent. $\text{Bi}_2\text{O}_3$ }	30–60 minims
— Hydrargyri Perchloridi .	$\frac{1}{2}$ gr. in 1 oz.	
— Hydrogenii Peroxidi . .		$\frac{1}{2}$ –2 fl. drachms
— Potassii Permanganatis .	1 per cent.	2–4 fl. drachms
— Ammonii Acetatis . . .		2–6 fl. drachms
— Ammonii Citratis . . .		
— Magnesii Carbonatis . .	2 per cent.	1–2 fl. oz.
— Calcis . . . . .	$\frac{1}{2}$ gr. in 1 oz.	1–4 fl. oz.

It will be noticed that the strength of the arsenical, atropine, morphine, strychnine, and trinitrin solutions is 1 per cent.

The following liquors are not usually administered internally; consequently no dose is given in the Pharmacopœia. They are for the most part caustic, irritant, or astringent, but some are used mainly in making other preparations:—Liquor Acidi Chromici, Liquor Ammoniaë Fortis, Liquor Ammoniaë, Liquor Calcis Chlorinataë, Liquor Caoutchouc, Liquor Epispasticus, Liquor Ferri Perchloridi Fortis, Liquor Ferri Persulphatis, Liquor Hamamelidis, Liquor Hydrargyri Nitratis Acidus, Liquor Iodi Fortis, Liquor Pancreatis, Liquor Picis Carbonis, Liquor Plumbi Subacetatis Fortis, Liquor Plumbi Subacetatis Dilutus, Liquor Sodii Ethylatis, Liquor Zinci Chloridi.

**Liquores Concentrati**—concentrated liquors. These are the official substitutes for concentrated infusions. They are similar to liquid extracts in mode of preparation, but they differ from these in strength and in the character of the drugs used to make them. They are all comparatively innocuous; most are bitter; two (rhubarb and senna) are purgative. Nearly all are made so that 2 oz. of liquor contain the active ingredients of 1 oz. of drug. In the case of senna 1 oz. of liquor represents 1 oz. of drug, and in the case of quassia 10 oz. of liquor are made from 1 oz. of drug. They all contain about 20 per cent. of alcohol with the exception of senega, which contains nearly 30 per cent.

The general method of preparation is as follows:—10 oz. of drug in coarse powder are moistened with 5 oz. of 20 per cent. alcohol, packed in a percolator and left three days. Two ounces of 20 per cent. alcohol are then poured on every twelve hours and percolation continued until 20 oz. have passed through. Thus prepared are **Liquor Chiratae Concentratus**, **Liquor Krameria Concentratus**, **Liquor Rhei Concentratus**, **Liquor Serpentariae Concentratus**. **Liquor Senegae Concentratus** is made with somewhat stronger alcohol; **Liquor Quassiae Concentratus** is made from 2 oz. of quassia which is moistened in the first instance with 2 oz. of 20 per cent. alcohol. **Liquor Calumbae Concentratus** is made by maceration and re-maceration in water, and **Liquor Sennae Concentratus** by re-percolating with water. In both cases alcohol is subsequently added, and, in the case of senna, tincture of ginger  $2\frac{1}{2}$  oz.

**Liquor Sarsae Compositus Concentratus** is peculiar in many ways—in being compound, in mode of preparation, and in dose. Besides sarsaparilla, it contains sassafras, guaiacum wood, liquorice root, and mezercon bark. They are extracted with boiling water, and alcohol is subsequently added.

Dose of all,  $\frac{1}{2}$ –1 fl. drachm : except

Liquor Serpentariae Concentratus,  $\frac{1}{2}$ –2 fl. drachms.

Liquor Sarsae Compositus Concentratus, 2–8 fl. drachms.

**Lotiones** — lotions. Watery solutions or mixtures adapted for external application. They are usually applied on lint.

There are only two in the Pharmacopœia. Both contain insoluble ingredients, and are made by double decomposition. Both are mercurial preparations. They are **Lotio Hydrargyri Flava**, **Lotio Hydrargyri Nigra**.



**Mella**—honeys. Clarified honey or this containing some medicinal ingredient.

Besides clarified honey (**Mel Depuratum**) only one other is official—**Mel Boracis** (borax, 1; glycerin,  $\frac{1}{2}$ ; honey, 8).

The glycerin ensures solution of the borax, and to a slight extent chemically interacts with it (see page 26).

**Misturæ**—mixtures. Mixtures of drugs in an aqueous medium adapted without further treatment for internal administration.

There are nine official. All but two contain insoluble ingredients which are suspended by a mucilaginous or albuminous substance; and most of these contain oil or resin, and are consequently emulsions.

#### Emulsions :

**Mistura Ammoniaci** (ammoniacum,  $\frac{1}{4}$  oz.; syrup of tolu,  $\frac{1}{2}$  oz.; distilled water,  $7\frac{1}{2}$  oz.).

— **Amygdalæ** (compound powder of almonds, 1 oz.; distilled water, 8 oz.).

— **Guaiaci** (guaiacum resin,  $\frac{1}{2}$  oz.; sugar,  $\frac{1}{2}$  oz.; tragacanth, 35 gr.; cinnamon water, 20 oz.).

— **Olei Ricini** (castor oil, 3 oz.; mucilage of gum acacia,  $1\frac{1}{2}$  oz.; commercial orange-flower water, undiluted, 1 oz.; cinnamon water,  $2\frac{1}{2}$  oz.).

— **Spiritus Vini Gallici** (brandy, 4 oz.; cinnamon water, 4 oz.; sugar,  $\frac{1}{2}$  oz.; two yolks of eggs).

#### Suspensions :

**Mistura Cretæ** (prepared chalk,  $\frac{1}{4}$  oz.; tragacanth, 15 gr.; sugar,  $\frac{1}{2}$  oz.; cinnamon water, to make 8 oz.).

— **Ferri Composita** (ferrous sulphate, 25 gr.; potassium carbonate, 30 gr.; myrrh, 60 gr.; sugar, 60 gr.; spirit of nutmeg, 50 minims; rose water, 10 oz.). Double decomposition occurs, and ferrous carbonate is formed. This is gradually oxidised and converted into ferric hydroxide.

#### Solutions :

**Mistura Creosoti** (creosote, 8 minims; spirit of juniper, 8 minims; syrup,  $\frac{1}{2}$  oz.; distilled water, to make 8 oz.).

**Mistura Sennæ Composita** (magnesium sulphate, 5 oz.; liquid extract of liquorice, 1 oz.; compound tincture of cardamoms, 2 oz.; aromatic spirits of ammonia, 1 oz.; infusion of senna, to make 20 oz.).

The dose of all, when repeatedly administered, is  $\frac{1}{2}$ –1 fl. ounce. The dose of those given as draughts—**Mistura Olei**

Ricini, Mistura Sennæ Composita, Mistura Spiritus Vini Gallici—is 1-2 fl. ounces.

**Mucilagines**—mucilages. Solutions or mixtures of gum and water of a syrupy consistence.

Two are official :

**Mucilago Acaciæ** (gum acacia, 4 oz. ; distilled water, 6 oz.).

— **Tragacanthæ** (tragacanth, 60 gr. ; alcohol, 2 dr. ; distilled water, to make 10 oz.).

They are used mainly for suspending substances insoluble in water.

**Olea**—oils. The pharmacopœial oils are of two kinds—fixed and volatile (see page 8). There is also one preparation—**Oleum Phosphoratum**, which is a one per cent. solution of phosphorus in almond oil (see page 95); and an empyreumatic oil—**Oleum Cadinum**—which is really a tar.

The doses of the oils are as follows :

**Oleum Phosphoratum**, 1-5 minims.

**Volatile Oils** (nearly all),  $\frac{1}{2}$ -3 minims.

**Olea Anethi, Anisi, Anthemidis, Cajuputi, Carui, Caryophylli, Cinnamomi, Coriandri, Eucalypti, Juniperi, Lavandulæ, Limonis, Menthæ Piperitæ, Menthæ Viridis, Myristicæ, Pimentæ, Rosmarini.**

*Exceptions :*

**Oleum Terebinthinæ**, 2-10 minims (as an anthelmintic, 3-4 fl. drachms).

— **Copaibæ** } 5-20 minims.

— **Cubebæ** }

— **Santali**, 5-30 minims.

**Oleum Cadinum, Oleum Rosæ, and Oleum Sinapis Volatile** are not given internally, and **Oleum Pini** is used only as an inhalation. These have consequently no official dose.

**Fixed Oils :**

**Oleum Crotonis**,  $\frac{1}{2}$ -1 minim.

— **Morrhua**, 1-4 fl. drachms.

— **Ricini**, 1-8 fl. drachms.

The rest have no official dose.

**Oleum Amygdalæ** and **Oleum Olivæ** are innocuous, and can be given in almost any dose. **Oleum Lini** is not given internally, and **Oleum Theobromatis** is used almost solely for making suppositories.

**Oxymella**—oxymels. Solutions consisting of honey, acetic acid, and water, with or without some medicinal ingredient.

There are two in the Pharmacopœia :

**Oxymel** (clarified honey, 8 ; acetic acid, 1 ; distilled water (about 1) to make sp. gr. 1·320).

Dose : 1–2 fl. drachms.

**Oxymel Scillæ** (squill, bruised,  $2\frac{1}{2}$  oz. ; acetic acid,  $2\frac{1}{2}$  oz. ; distilled water, 8 oz. ; digest 7 days ; press and filter until 10 oz. are obtained. Add clarified honey (about 27 oz.) to produce sp. gr. 1·320).

Dose :  $\frac{1}{2}$ –1 fl. drachm.

**Pilulæ**—pills. Small spherical or spheroidal masses of medicinal substances adapted for being swallowed whole. The pharmacopœial pills are really pill-masses capable of being made into pills. They are more conveniently prescribed in this form.

Nearly all the official pills are compound. They are prepared by thoroughly mixing various active substances with other more or less inert substances (known as excipients) into a uniform mass of clayey consistence. This is subsequently cut, according to prescription, into pea-like bodies by a suitable machine. The weight should not exceed, except in the case of very heavy substances, 5 grains.

The official pills may be divided into (i.) purgative pills ; (ii.) pills containing opium (used both for intestinal and general effects) ; (iii.) pills intended to be absorbed and produce a general or remote action.

(i.) **Purgative.**

(a) containing aloes :

(a) containing Barbados aloes :

**Pilula Aloes Barbadosensis**

— Aloes et Ferri

— Cambogiæ Composita

— Colocynthis Composita

— Colocynthis et Hyoscyami

(β) containing Socotrine aloes :

**Pilula Aloes Socotrinæ**

— Aloes et Asafetidæ

— Aloes et Myrrhæ

— Rhei Composita

(b) **Pilula Scammonii Composita** (contains no aloes)

(c) containing mereury, free or combined :

**Pilula Hydrargyri**

— Hydrargyri Subchloridi Composita<sup>1</sup>

Dose

4–8 grains

**Pilula Hydrargyri Subchloridi Composita** is frequently used to obtain the general action of its constituents (see page 188).

(ii.) **Containing Opium.**

	Proportion of opium	Dose
Pilula Saponis Composita . . . . .	1 in 5	2-4 grains
— Plumbi cum Opio . . . . .	1 in 8	2-4 grains
— Ipecacuanhæ cum Scilla . . . . .	1 in 20	4-8 grains

(iii.) **For Absorption.**

Pilula Phosphori (contains 2 per cent. of phosphorus) . . . . .	1-2 grains
— Quininæ Sulphatis (6 grains contain 5 grains of quinine sulphate) . . . . .	2-8 grains
— Galbani Composita . . . . .	4-8 grains
— Scillæ Composita . . . . .	4-8 grains
— Ferri (1 grain of ferrous carbonate in 5 grains) . . . . .	5-15 grains

**Pulveres**—powders. Intimate mixtures of finely powdered drugs of a non-deliquescent nature.

Nearly all official powders are comparatively insoluble in water, and are used mainly for their local effect upon the alimentary tract. All but two—Pulvis Antimonialis and Pulvis Elaterini Compositus (misnamed compound)—are compound.

There are sixteen powders official. They may be divided into (i.) purgative powders; (ii.) powders containing opium; (iii.) astringent powders; (iv.) other powders.

(i.) **Purgative** (most powerful first).

	Dose
Pulvis Elaterini Compositus (1 in 40 of elaterin)	1-4 grains
— Scammonii Compositus (scammony resin, 4; jalap, 3; ginger, 1) . . . . .	10-20 grains
— Jalapæ Compositus (jalap, 5; acid potassium tartrate, 9; ginger, 1) . . . . .	20-60 grains
— Rhei Compositus (rhubarb, 2; magnesia, 6; ginger, 1) . . . . .	
— Glycyrrhizæ Compositus (senna, 2; sulphur, 1; fennel fruit, 1; liquorice root, 2; sugar, 6) . . . . .	60-120 grains
— Sodæ Tartratæ Effervescens (sodium potassium tartrate 120 gr., sodium bicarbonate 40 gr., in blue paper; tartaric acid 38 gr. in white paper) . . . . .	one powder



(ii.) **Containing Opium.**

	Dose
<b>Pulvis Opii Compositus</b> (10 per cent. opium with aromatics — black pepper, ginger, caraway fruit) . . . . .	2-10 grains
— <b>Kino Compositus</b> (kino, 15; opium, 1; cinnamon bark, 4) . . . . .	5-20 grains
— <b>Ipecacuanhæ Compositus</b> (ipecacuanha root, 1; opium, 1; potassium sulphate, 8) . . . . .	5-15 grains
— <b>Cretæ Aromaticus cum Opio</b> (2½ per cent. opium) . . . . .	10-40 grains

(iii.) **Astringent Powders.**

<b>Pulvis Catechu Compositus</b> (catechu, 4; kino, 2; krameria root, 2; cinnamon bark, 1; nutmeg, 1) . . . . .	10-40 grains
— <b>Cretæ Aromaticus</b> (nearly ¼ chalk with aromatics and sugar) . . . . .	10-60 grains
— <b>Cinnamomi Compositus</b> (cinnamon bark, 1; cardamom seeds, 1; ginger, 1). Mainly carminative . . . . .	10-40 grains

**Pulvis Kino Compositus** and **Pulvis Cretæ Aromaticus cum Opio** (see above) are also astringent powders.

(iv.) **Other Powders.**

<b>Pulvis Antimonialis</b> (antimony oxide, 1; calcium phosphate, 2) . . . . .	3-6 grains
— <b>Tragacanthæ Compositus</b> (tragacanth, gum acacia, starch, of each 1; sugar, 3). Mainly used as an emulsifying agent or excipient . . . . .	20-60 grains
— <b>Amygdalæ Compositus</b> (almonds, 8; sugar, 4; gum acacia, 1) is used in making <i>Mistura Amygdalæ</i> . It is innocuous . . . . .	no dose given

**Spiritus**—spirits. Colourless, or almost colourless, alcoholic solutions containing volatile substances.

**Spiritus Rectificatus**, the basis of the other spirits, is simply 90 per cent. alcohol (ethyl hydroxide) and 10 per cent. water, by volume (see page 206).

There are seventeen other spirits official. They may be divided as follows :—

- (a) Volatile substance, a volatile oil or similar compound. Made by dissolving the oil &c. in rectified spirit. The addition of a moderate amount of water causes precipitation of much of the volatile substance.

(i.) **Solutions of volatile oils.**

	Strength	Dose
<b>Spiritus Anisi</b> . . . . .		
— <b>Cajuputi</b> . . . . .		
— <b>Cinnamomi</b> . . . . .	1 in 10	5–20 minims
— <b>Lavandulæ</b> . . . . .		
— <b>Menthæ Piperitæ</b> . . . . .		
— <b>Myristicæ</b> . . . . .		
— <b>Rosmarini</b> . . . . .	1 in 10	no dose given
— <b>Juniperi</b> . . . . .	1 in 20	20–60 minims

(ii.) **Solution of Camphor.**

<b>Spiritus Camphoræ</b> . . . . .	1 in 10	5–20 minims
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(b) Volatile substance, ehloroform. Water in moderate amounts causes preeipitation of the ehloroform.

<b>Spiritus Chloroformi</b> . . . . .	1 in 20	5–20 minims
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(Dose for single administration, 30–40 minims)

(c) Volatile substances, ethers or esters :

(i.) simple.

**Spiritus Ætheris** (ether, 1 ; aleohol, 2)

(ii.) compound.

**Spiritus Ætheris Compositus** (a solution of ethyl sulphate &c.

See page 215) . . . . .

— **Ætheris Nitrosi** (contains ethyl nitrite  $2\frac{1}{2}$  per cent., aldehyde etc. See page 226) . . . . .

— **Vini Gallici**—brandy . . . . . no official dose

20–40 minims for repeated administration ; 60–90 minims for single administration

(d) Compound spirits :

**Spiritus Ammoniaë Aromaticus** (contains strong solution of ammonia, ammonium earbonate and the oils of nutmeg and lemon) . . . . .

— **Ammoniaë Fetidus** (contains the volatile ingredients of asafetida and strong solution of ammonia)

— **Armoraciæ Compositus** (contains the volatile ingredients of horse-radish root, bitter orange-peel, and nutmeg) . . . . .

20–40 minims for repeated administration ; 60–90 minims for single administration

1–2 fluid draehms

All the compound spirits are prepared by distillation, wholly or in part, and contain nothing but volatile ingredients.

**Succi**—juices. Juices pressed from fresh plants or parts of plants. To all, except lemon juice, one-third of their

volume of 90 per cent. alcohol is added ; they are then kept seven days and filtered.

The Pharmacopœia contains six :

	Dose
Succus Belladonnæ . . . . .	5-15 minims
— Hyoscyami . . . . .	$\frac{1}{2}$ -1 fl. draehm
— Conii . . . . .	} 1-2 fl. draehms
— Scoparii . . . . .	
— Taraxaci . . . . .	
— Limonis (contains 30-40 gr. of citric acid in 1 fl. oz.) . . . . .	no dose given

**Suppositoria**—suppositories. Solid preparations usually conical or bullet-shaped, melting at the temperature of the body, and containing some medicinal (or nutritive) agent. They are administered per anum.

With one exception the weight of all the pharmacopœial suppositories is 15 grains and the basis oil of theobroma. Glycerin suppository has a gelatin basis and may weigh 30, 60, or 120 grains.

There are seven suppositories official. Except gelatin suppository, they are all made by just melting the proper amount of oil of theobroma, incorporating the active ingredient or ingredients, and pouring into a suitable mould. The phenol suppository contains a little wax. One suppository is compound.

In India and the Colonies more or less white beeswax may be used in place of an equivalent amount of oil of theobroma if the suppository would otherwise be too soft for use.

	In each suppository
Suppositoria Belladonnæ . . . . .	$1\frac{1}{2}$ gr. alcoholic extract (about $\frac{1}{60}$ gr. of alkaloids of root)
— Morphinæ . . . . .	$\frac{1}{4}$ gr. morphine hydrochloride
— Plumbi Composita . . . . .	1 gr. opium, 3 gr. lead acetate
— Acidi Carbolici . . . . .	1 gr. phenol
— Acidi Tannici . . . . .	3 gr. tannic acid
— Iodoformi . . . . .	3 gr. iodoform
— Glycerini . . . . .	70 per cent. glycerin

**Syrupi**—syrups. Fluid preparations (infusions, diluted tinctures, juices, &c.) saturated or almost saturated with sugar. Syrupus Cascaræ Aromaticus and Syrupus Aromaticus contain a relatively small quantity of sugar.

There are twenty-two in the Pharmacopœia. The mode of preparation varies considerably.

**Syrupus**—simple syrup—consists of 1 lb. of sugar dissolved in sufficient boiling distilled water to make  $1\frac{1}{2}$  lb. of syrup.

**Syrupus Glucosi** consists of liquid glucose 1 part, syrup 2 parts, and is used merely as a pill excipient.

The remaining syrups may be divided according to their chief use into (i.) colouring, (ii.) flavouring, and (iii.) medicinal.

(i.) Colouring syrups :

**Syrupus Rhœados** (made from red poppy petals)  
— **Rosæ** (made from dried red-rose petals)

Dose

(ii.) Flavouring syrups :

**Syrupus Aromaticus** (tincture of orange, 1 ; cinnamon water, 1 ; syrup, 2)

— **Aurantii** (tincture of orange, 1 ; syrup, 7)

— **Aurantii Floris** (orange-flower water saturated with sugar)

— **Limonis** (a saturated solution of sugar in lemon juice containing a little tincture of lemon peel). It is acid.

— **Zingiberis** (ginger,  $\frac{1}{2}$  oz., made into 1 oz. of strong tincture ; syrup to make 20 oz.). Possesses also the carminative action of ginger.

$\frac{1}{2}$ –1 fluid  
drachm

(iii.) Medicinal syrups :

(a) Used mainly in bronchial affections.

**Syrupus Codeinæ** ( $\frac{1}{4}$  gr. codeine phosphate in 1 drachm)

— **Scillæ** (vinegar of squill, 20 oz. ; sugar, 38 oz.)

— **Tolutani** (balsam of tolu,  $1\frac{1}{4}$  oz. ; sugar, 2 lbs. ; water, to make 3 lbs.)

— **Hemidesmi** (hemidesmus root, 4 oz., in 2 lbs. 10 oz. of the syrup)

— **Pruni Virginianæ** (Virginian prune bark, 3 oz. ; glycerin,  $1\frac{1}{4}$  oz. ; in 20 fl. oz. of the syrup). Contains hydrocyanic acid, owing to decomposition of the glucoside in the bark.

$\frac{1}{2}$ –2 fluid  
drachms

$\frac{1}{2}$ –1 fluid  
drachm

(b) Purgative syrups.

**Syrupus Cascaræ Aromaticus** (liquid extract of cascara sagrada, 8 oz. ; tincture of orange, 2 oz. ; alcohol, 1 oz. ; cinnamon water, 3 oz. ; syrup, 6 oz.)

— **Rhei** (rhubarb root, 2 oz. ; coriander fruit, 2 oz. ; in nearly  $2\frac{1}{2}$  lbs. of the syrup)

— **Sennæ** (senna, 40 oz. ; oil of coriander, 10 minims ; in 5 lbs. 12 oz. of the syrup)

$\frac{1}{2}$ –2 fluid  
drachms



(iii.) Medicinal syrups (*continued*) :

(c) Hypnotic syrup.

<b>Syrupus Chloral</b> (chloral hydrate, 10 gr., in 1 fluid draehm of syrup)	Dose } $\frac{1}{2}$ 2 fluid draehms
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(d) Syrups modifying metabolism &c.

<b>Syrupus Calcii Lacto-phosphatis</b> (contains 1 per cent. of calcium combined as a lacto-phos- phate, and a little orange-flower water)	} $\frac{1}{2}$ -1 fluid draehm
— <b>Ferri Phosphatis</b> (contains 1 gr. of anhydrous ferrous phosphate in 1 fluid draehm of syrup)	
— <b>Ferri Phosphatis cum Quinina et Strychnina</b> (contains 1 gr. of anhydrous ferrous phos- phate, $\frac{1}{8}$ gr. of quinine sulphate, and $\frac{1}{32}$ gr. of strychnine in 1 fluid draehm)	
— <b>Ferri Iodidi</b> (contains 10 per cent. of ferrous iodide)	

**Tabellæ**—tablets. Small flat discs of chocolate contain-  
ing some medicinal ingredient.

Only one is official. It weighs 5 gr.

**Tabellæ Trinitrini** (each contains  $\frac{1}{100}$  gr. of nitroglycerin).  
Dose, 1 or 2 tablets.

**Tincturæ**—tinctures. Alcoholic solutions of active  
substances prepared by maceration, percolation, or simple  
admixture. They differ from spirits in containing non-vola-  
tile ingredients (except tincture of iodine); in not being  
subjected to distillation during any part of their preparation;  
and in being coloured (except ammoniated tincture of quinine  
and tincture of strophanthus, which are practically colourless).

There are sixty-seven tinctures official. They are the commonest form  
of preparation, because most of the active principles of drugs are soluble  
in alcohol, while the inactive and bulky residue (gummy and albuminous  
matters, woody fibre, &c.) is insoluble. Most are prepared by maceration  
or percolation, a few by simple mixture. The amount of solid taken and  
the strength of the alcohol vary in the different tinctures. The strength  
of alcohol is that best adapted for exhausting the drug most completely  
and economically, and varies from 45 to 90 per cent. The strongest  
alcohol is used where the active principles of the drug are insoluble in  
water (*e.g.* resins); the weaker alcohols when the active substances are  
not quite insoluble in water. Thus we find that most drugs having both  
a tincture and an infusion as preparations have the tincture made with  
alcohol under 90 per cent. strength.

The amount of active medicament in the different tinctures varies because an almost uniform dosage has been adopted, and crude drugs vary both as regards the activity of their active constituents and the amount of them they contain. In most of the simple tinctures, however, 1 pint is made from 1, 2, or 4 oz. of crude drug (in the case of cantharides from  $\frac{1}{4}$  oz.; of iodine from  $\frac{1}{2}$  oz.).

On account of the number of preparations, the variability in strength, mode of preparation and use, the tinctures are difficult to classify satisfactorily. They fall into two main groups according to the dose, and they may be further subdivided into simple, compound, ammoniated, and ethereal.

The following table gives most of the necessary information regarding them. s. = simple solution; p. = percolation; m. = maceration. The strength of alcohol given is that of the finished tincture.

SIMPLE TINCTURES

		Amount per pint	Mode of preparation	Strength of alcohol
<b>Dose: 2-5 minims.</b>				
Tinctura Iodi	.	$\frac{1}{2}$ oz.	s.	90 per cent.
<b>Dose: 5-15 minims.</b>				
Tinctura Belladonnæ	.	{ 1 oz. liquid extract in 15 oz. (.05 per cent. alkaloids) }	s.	60 per cent.
— Cannabis Indicæ	.		s.	90 per cent.
— Ferri Perchloridi	.	5 $\frac{1}{2}$ per cent. Fe	s.	25 per cent.
— Nucis Vomicae	.	{ 1 oz. liquid extract in 6 (.25 per cent. strychnine) }	s.	{ nearly 70 per cent.
— Podophylli	.		s.	90 per cent.
— Strophanthi	.	$\frac{1}{2}$ oz.	p.	70 per cent.
— Aconiti <sup>1</sup>	.	1 oz.	p.	70 per cent.
— Gelsemii	.	2 oz.	p.	60 per cent.
— Digitalis	.	2 $\frac{1}{2}$ oz.	p.	60 per cent.
— Colchici Seminis	.	4 oz.	p.	45 per cent.
— Stramonii	.	4 oz.	p.	45 per cent.
— Cantharidis <sup>1</sup>	.	$\frac{1}{4}$ oz.	m.	90 per cent.
— Capsici	.	1 oz.	m.	70 per cent.
— Croci	.	1 oz.	m.	60 per cent.
— Cocci	.	2 oz.	m.	45 per cent.
— Opii	.	{ 3 oz. (0.75 per cent. morphine) }	m.	45 per cent.
— Scillæ	.		m.	60 per cent.

<sup>1</sup> Dose for repeated administration, 2-5 minims.

SIMPLE TINCTURES (*continued*)

	Amount per pint	Mode of preparation	Strength of alcohol
<b>Dose: 30-60 minims.</b>			
Tinctura Tolutana . . .	2 oz.	s.	90 per cent.
— Quillaia . . .	1 oz.	p.	60 per cent.
— Chirata . . .	2 oz.	p.	60 per cent.
— Cimicifuga . . .	2 oz.	p.	60 per cent.
— Hamamelidis . . .	2 oz.	p.	45 per cent.
— Hydrastis . . .	2 oz.	p.	60 per cent.
— Hyoscyami . . .	2 oz.	p.	45 per cent.
— Zingiberis . . .	2 oz.	p.	90 per cent.
— Buchu . . .	4 oz.	p.	60 per cent.
— Cascarilla . . .	4 oz.	p.	70 per cent.
— Cinchona . . .	4 oz. (1 per cent. alkaloids)	p.	70 per cent.
— Cinnamomi . . .	4 oz.	p.	70 per cent.
— Conii . . .	4 oz.	p.	70 per cent.
— Cubeba . . .	4 oz.	p.	90 per cent.
— Jaborandi . . .	4 oz.	p.	45 per cent.
— Jalapa . . .	4 oz. (1.5 per cent. resin)	p.	70 per cent.
— Krameria . . .	4 oz.	p.	60 per cent.
— Senega . . .	4 oz.	p.	60 per cent.
— Serpentaria . . .	4 oz.	p.	70 per cent.
— Calumba . . .	2 oz.	m.	60 per cent.
— Quassia . . .	2 oz.	m.	45 per cent.
— Sumbul . . .	2 oz.	m.	70 per cent.
— Asafetida . . .	4 oz.	m.	70 per cent.
— Lupuli . . .	4 oz.	m.	60 per cent.
— Myrrha . . .	4 oz.	m.	90 per cent.
— Pruni Virginiana . . .	4 oz.	m.	{ nearly 60 per cent.
— Aurantii . . .	5 oz.	m.	90 per cent.
— Limonis . . .	5 oz.	m.	90 per cent.

Simple, but contain some other ingredient:

Tinctura Aloes (con- tains liquorice) . . .	$\frac{1}{2}$ oz.	s.	45 per cent.
— Kino (contains gly- cerin) . . .	2 oz.	s.	{ about 50 per cent.
— Catechu (contains cinnamon) . . .	4 oz.	s.	60 per cent.
— Quinia (made with tincture of orange) {	175 gr. Q. sulphate }	s.	90 per cent.

The following simple tinctures have no dose :—

	Amount per pint	Mode of preparation	Strength of alcohol
Tinctura Arnicæ . . .	1 oz.	p.	70 per cent.
— Pyrethri . . .	4 oz.	p.	70 per cent.

COMPOUND TINCTURES

Dose : 5-15 minims.

	Mode of preparation	Strength of alcohol
Tinctura Chloroformi et Morphinæ Composita (10 minims contain $\frac{3}{4}$ minim chloroform, 1 minim tincture of cannabis indica, $\frac{1}{2}$ minim dilute hydrocyanic acid, $\frac{1}{11}$ gr. morphine hydrochloride. Also contains capsicum, peppermint, and glycerin) .	s.	90 per cent.

Dose : 30-60 minims.

Tinctura Benzoini Composita (benzoin, 2 oz.; storax, $1\frac{1}{2}$ oz.; balsam of tolu, $\frac{1}{2}$ oz.; socotrine aloes, 160 gr. — in 1 pint) . . . . .	s.	90 per cent.
— Camphoræ Composita (tincture of opium, 585 minims; benzoic acid, 40 gr.; camphor, 30 gr.; oil of anise, 30 minims; 60 per cent. alcohol, to make 1 pint). One fluid drachm contains $\frac{1}{10}$ gr. of morphine . . . . .	s.	60 per cent.
— Cardamomi Composita (cardamom seeds, $\frac{1}{4}$ oz.; caraway fruit, $\frac{1}{4}$ oz.; raisins, freed from seeds, 2 oz.; cinnamon bark, $\frac{1}{2}$ oz.; cochineal, 55 gr.; 60 per cent. alcohol, to make 1 pint) . . . . .	m.	60 per cent.
— Cinchonæ Composita (tincture of cinchona, 10 oz.; orange peel, 1 oz.; serpentary rhizome, $\frac{1}{2}$ oz.; cochineal, 28 gr.; saffron, 55 gr.; 70 per cent. alcohol, to make 1 pint). Contains 0.5 per cent. alkaloids . . . . .	m.	70 per cent.
— Gentianæ Composita (gentian root, 2 oz.; bitter orange peel, $\frac{3}{4}$ oz.; cardamom seeds, $\frac{1}{4}$ oz.; 45 per cent. alcohol, to make 1 pint) . . . . .	m.	45 per cent.
— Lavandulæ Composita (oil of lavender, 45 minims; oil of rosemary, 5 minims; cinnamon bark, 75 gr.; nutmeg, 75 gr.; red sanders wood, 150 gr.; alcohol (90 per cent.), 1 pint) . . . . .	s. and m.	90 per cent.



COMPOUND TINCTURES (*continued*)**Dose : 30-60 minims.**

	Mode of preparation	Strength of alcohol
<b>Tinctura Rhei Composita</b> (rhubarb root, 2 oz.; cardamom seeds, $\frac{1}{4}$ oz.; coriander fruit, $\frac{1}{4}$ oz.; glycerin, 2 oz.; 60 per cent. alcohol, to make 1 pint) . . .	p.	54 per cent.
— <b>Sennæ Composita</b> (senna, 4 oz.; raisins, 2 oz.; caraway fruit, $\frac{1}{2}$ oz.; coriander fruit, $\frac{1}{2}$ oz.; 45 per cent. alcohol, to make 1 pint). Dose for single administration, 2-4 fl. drachms . . .	m.	45 per cent.

## AMMONIATED TINCTURES

**Dose : 30-60 minims.**

<b>Tinctura Ergotæ Ammoniata</b> (ergot, 5 oz.; solution of ammonia, 2 oz.; 60 per cent. alcohol, to make 1 pint) . . .	p.	60 per cent.
— <b>Guaiaci Ammoniata</b> (guaiacum resin, 4 oz.; oil of nutmeg, 30 minims; oil of lemon, 20 minims; strong solution of ammonia, $1\frac{1}{2}$ oz.; alcohol, to make 1 pint) . . . . .	s.	90 per cent.
— <b>Opîi Ammoniata</b> (tincture of opium, 3 oz.; benzoic acid, 180 gr.; oil of anise, 1 dr.; solution of ammonia, 4 oz.; alcohol (90 per cent.), to make 1 pint). Contains nearly $\frac{1}{16}$ gr. of morphine in each fluid drachm . . .	s.	65 per cent.
— <b>Quininæ Ammoniata</b> (quinine sulphate, 175 gr.; solution of ammonia, 2 oz.; 60 per cent. alcohol, to make 1 pint)	s.	54 per cent.
— <b>Valerianæ Ammoniata</b> (valerian rhizome, 4 oz.; oil of nutmeg, 30 minims; oil of lemon, 20 minims; solution of ammonia, 2 oz.; 60 per cent. alcohol, to make 1 pint) . . . . .	m.	54 per cent.

## ETHEREAL TINCTURE

**Dose : 5-15 minims.**

<b>Tinctura Lobeliæ Ætherea</b> (lobelia, 4 oz.; spirit of ether, to make 1 pint) . . .	p.
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The ammonia in the ammoniacal tinctures and the ether in the ethereal tincture are of pharmacological importance; they play little or no part as solvents.

**Trochisci**—lozenges. Dry tablets made of gum and sugar, containing some medicinal ingredient. In most cases a flavouring agent is also added. The presence or absence of this determines the basis.

The Pharmacopœia recognises four bases :

Simple basis—without flavouring ingredient.

Fruit basis—flavoured with black-currant paste.

Rose basis—flavoured with rose water.

Tolu basis—flavoured with tincture of tolu.

The Pharmacopœia contains seventeen lozenges :

#### SIMPLE BASIS

	Amount of active ingredient in each
Trochiscus Catechu . . . .	1 gr.
— Ferri Redacti . . . .	1 gr.
— Santonini . . . .	1 gr.

#### ROSE BASIS

Trochiscus Potassii Chloratis . .	3 gr.
— Sodii Bicarbonatis . . . .	3 gr.
— Bismuthi Compositus . . . .	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">{</div> <div style="display: inline-block; vertical-align: middle;">           bismuth oxycarbonate, 2 gr.            magnesium carbonate, 2 gr.            calcium carbonate, 4 gr.         </div> </div>

#### FRUIT BASIS

Trochiscus Acidi Benzoici . . . .	$\frac{1}{2}$ gr.
— Acidi Tannici . . . .	$\frac{1}{2}$ gr.
— Ipecacuanhæ . . . .	$\frac{1}{2}$ gr.
— Eucalypti Gummi . . . .	1 gr.
— Krameriæ . . . .	1 gr. of extract
— Krameriæ et Cocainæ . . . .	1 gr. extract ; $\frac{1}{30}$ gr. cocaine hydrochloride
— Guaiaci Resinæ . . . .	3 gr.

#### TOLU BASIS

Trochiscus Morphinæ . . . .	$\frac{1}{36}$ gr. morphine hydrochloride
— Morphinæ et Ipecacuanhæ . . . .	$\frac{1}{36}$ gr. morphine hydrochloride, $\frac{1}{12}$ gr. ipecacuanha root
— Acidi Carbolici . . . .	1 gr.

**Trochiscus Sulphuris** is prepared according to a somewhat different formula from that of the other lozenges. Each contains of precipitated sulphur, 5 gr. ; acid potassium tartrate, 1 gr. ; sugar, 8 gr. ; gum acacia, 1 gr. ; tincture of orange, 1 minim ; mucilage of acacia, 1 minim.

**Unguenta**—ointments. Semi-solid preparations for external application made of a fatty, waxy, or paraffin basis, and usually containing some other medicinal ingredient. Most of the ointments are made with lard, oil, or hard and soft paraffins. Two (conium, hamamelis) are made with hydrous wool fat (lanolin), because this mixes best with watery substances.

Paraffins possess one advantage over lard in that they do not go rancid. They are, however, not absorbed so readily, and consequently are best retained for substances which are not required to penetrate deeply.

The ointments are prepared by simple mixture, usually by rubbing the ingredients together until the product assumes a smooth, uniform consistence. Occasionally some of the constituents (*e.g.* wax, spermaceti) have to be melted previously, and in a few instances (potassium iodide phenol, and the alkaloidal ointments) a solvent is used to dissolve the active substance. The lard used in most cases is benzoated lard, because

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**Bases :**

1 in 5

Ungt. Aquæ Rosæ

— Cetacei

— Paraffini

8 in 30

Ungt. Resinæ

1 in 2

Ungt. Hydrargyri

Ungt. Hydrargyri Co.

1 in 4

Ungt. Hydrargyri  
Oleatis

3 in 10

Ungt. Zinci

Ungt. Glycerini Plumbi  
Subacetatis (p)

2 in 11½

Ungt. Staphisagriæ

12 in 62

— Capsici

this keeps better than pure lard. The hard and soft paraffins of the Pharmacopœia are respectively too hard and soft for general use as ointment bases, hence a mixture of the two is official as **Unguentum Paraffini**. This consists of hard paraffin 3, soft paraffin 7, but the proportions may be varied to meet the exigencies of climate and prevailing temperature. The Pharmacopœia states that 'when Paraffin Ointment is used as the basis of white ointments it should be prepared with the white variety of Soft Paraffin; and when used in coloured ointments it should be prepared with the yellow variety of Soft Paraffin.'

In India and the Colonies, more or less indurated lard, prepared suet, yellow beeswax, or white beeswax may be used to give proper consistence to ointments, providing that the official proportion of the active ingredient is maintained.

There are forty-four ointments official in the Pharmacopœia. The following table gives the strength of the active ingredients and most of the information it is necessary to know concerning them. Those ointments most closely associated in chemical composition will be found nearest together either horizontally or vertically; p = paraffin basis; the rest (except the bases) have a lard basis.

1 in 10	1 in 25	1 in 50	
	Ungt. Cocainæ	Ungt. Aconitinæ	} Alkaloidal ointments
		— Atropinæ	
		— Veratrinæ	
Ungt. Creosoti (p)			
— Eucalypti (p)			
— Acidi Borici (p)	Ungt. Acidi Carbolici (p)	Ungt. Acidi Salicylici (p)	
— Iodoformi (p)	— Iodi		
— Plumbi Iodidi (p)	— Sulphuris Iodidi		
— Potassii Iodidi (p)	— Hydrarg. Iodidi Rubri	— Hydrarg. Oxidi Flavi (p)	
— Sulphuris			
— Hydrarg. Oxidi Rubri (p)			
— Hydrargyri Ammoniaci (p)			
— Hydrargyri Subchloridi (p)			
— Plumbi Carbonatis (p)	— Plumbi Acetatis (p)		
— Cantharidis	— Chrysarobini		



### Ointments with a special mode of Preparation or a special Basis.

- Ungt. Conii.**—Succus Conii, 2 oz.; evaporate to  $\frac{1}{4}$  oz.; mix with hydrous wool fat,  $\frac{3}{4}$  oz.
- **Hamamelidis.**—Liquid extract,  $\frac{1}{4}$  oz.; mix with hydrous wool fat,  $2\frac{1}{4}$  oz.
- **Belladonnæ.**—Liquid extract, 2 oz.; evaporate to  $\frac{1}{4}$  oz.; mix with benzoated lard,  $2\frac{1}{4}$  oz. (contains .6 per cent. alkaloids).
- **Picis Liquidæ.**—Tar, 5 oz.; yellow beeswax, 2 oz.
- **Hydrargyri Nitratis.**—Mercury, 1 oz.; nitric acid, 3 oz.; dissolve without heat; add gradually to lard, 4 oz.; olive oil, 7 oz., previously mixed and heated to  $143.3^{\circ}\text{C}$ .
- Ungt. Hydrargyri Nitratis Dilutum.**—1 in 5 (p).
- **Zinci Oleatis.**—Zinc sulphate, 2 oz.; hard soap, 4 oz.; dissolve in water and mix; double decomposition occurs; mix the zinc oleate with an equal weight of soft paraffin.

**Vina**—wines. Liquids obtained by fermenting grape juice (Vinum Xericum) or a saccharine solution containing bitter orange peel (Vinum Aurantii), or these containing some medicinal ingredient. The latter are similar preparations to tinctures; they differ in being made with wine in place of alcohol.

There are eight official:

Simple wines:

Vinum Aurantii	} No official dose; only used to prepare the medicated wines.
— Xericum (sherry)	

Medicated wines:

(a) Made from sherry.

	Strength	Dose
Vinum Antimoniale	2 gr. tartar emetic in 1 oz.	10-30 minims (emetic dose, 2-4 fl. dr.)
— Ipecacuanhæ .	1 oz. liquid extract in 20 oz.	10-30 minims (emetic dose, 4-6 fl. dr.)
— Colchici . . .	4 oz. colchicum corm in 20 oz.; macerate	10-30 minims
— Ferri . . . .	1 oz. iron wire in 20 oz.; macerate 30 days (see page 167)	1-4 fl. drachms

(b) Made from orange wine.

Vinum Ferri Citratis	1 gr. in 1 dr.	1-4 fl. drachms
— Quininæ . . .	1 gr. quinine hydro- chloridè in 1 oz.	$\frac{1}{2}$ -1 fl. ounce

## PHARMACOPŒIAL STANDARDS

A PHARMACOPŒIA does not require absolute purity in all its drugs. In the case of manufactured substances this is difficult to attain. Traces of chlorides and sulphates, for example, are very difficult to remove from many inorganic salts. Their removal entails a considerable amount of labour and corresponding increase in price without corresponding benefit, since their presence is of no pharmacological importance. A Pharmacopœia does, however, insist on its drugs being, as a rule, the purest commercially obtainable, and with this end in view it inserts certain tests to which the drug must conform. These tests for manufactured substances are qualitative and often quantitative. The qualitative tests include (*a*) tests to prove the identity of the drug; (*b*) tests to prove the absence or limit of impurities. Potassium acetate may be taken as an example. The Pharmacopœia says: 'It yields the reactions characteristic of potassium and of acetates, and should yield no characteristic reaction with the tests for lead, copper, arsenium, iron, aluminium, calcium, magnesium, carbonates, or sulphides, and only the slightest reactions with the tests for chlorides or sulphates.' This terminology, with slight variations, is repeated in nearly all the descriptions of metallic salts. The characteristic tests for the various ions are given in the Appendix to the Pharmacopœia, and are probably familiar to the student. Less familiar tests are included in the description of each drug.

The impurities in a manufactured drug are usually the substances from which it has been made or the impurities already present in these. Intentional adulteration, with few exceptions (musk, saffron), is uncommon. Drugs may, however, deteriorate by keeping, *e.g.* oxides may be converted into

carbonates, or carbonates into oxides, or a deliquescent drug may take up water, or a preparation containing a volatile substance may diminish in strength. The first-named changes can be detected qualitatively; the last quantitatively.

The quantitative tests ensure the drug being up to a certain standard strength. They are included, if possible, wherever necessary, and are gravimetric or volumetric. In many cases a certain latitude is allowed, because the commercial drug may contain small quantities of innocuous impurities or a slight variable quantity of water, &c. Thus in the case of potassium iodide the Pharmacopœia states that 'each gramme should require for complete precipitation not less than 59·5 nor more than 61·9 cubic centimetres of the volumetric solution of silver nitrate.' A gramme of pure potassium iodide should require 60·7 c.c. of the silver nitrate solution, which is the mean of the pharmacopœial limits. A higher value than 61·9 would mean a larger quantity of chlorides and bromides than the Pharmacopœia allows; a lower number than 59·5 indicates an unnecessarily large quantity of impurities unaffected by silver nitrate. In other cases the latitude is allowable because the substance decomposes or volatilises on keeping. Sweet spirit of nitre, for example, should give, when freshly prepared and treated in the manner described in the Pharmacopœia, 'at least  $6\frac{1}{4}$ , but not more than 7, volumes of nitric oxide gas, corresponding to at least  $2\frac{1}{2}$  parts by weight of ethyl nitrite in 100 parts by weight of the spirit; and even after it has been kept some time, and the vessel containing it has occasionally been opened, it should yield not much less than 5 times its volume of the gas, corresponding to nearly 2 per cent. by weight of ethyl nitrite or a minimum of  $1\frac{3}{4}$  per cent.' In the case of powerfully active substances variations are not allowed. Thus the diluted hydrocyanic acid, although very volatile, must conform to a 2 per cent. standard.

These examples will suffice to show the meaning of pharmacopœial purity. The intention of the pharmacopœial authorities is to ensure a high standard which can easily be obtained commercially, and can be maintained by careful keeping, and in all cases to ensure the absence of substances

likely to have a deleterious effect when the drug is used in medicine. In a few cases the pharmacopœial standard is undoubtedly too high ; in some it is too low.

In the following descriptions of inorganic drugs mention will be made only of the impurities which are allowed, the absence of all others is assumed ; and only the results of such quantitative tests as are of importance will be given. For the method employed the student is referred to the Pharmacopœia.

The purely organic drugs are not, in the majority of cases, supplied with a quantitative test in the true sense of the term. This, however, except in a few instances, is unnecessary, as the melting or boiling points of these substances are a sufficient guarantee of their purity. Tests are given to show the absence of the most likely impurities ; and the amount of ash left after combustion, showing the absence or limit of inorganic impurity, is also frequently given.

The crude vegetable and animal drugs are more difficult to define. The Pharmacopœia gives the animal or plant from which they are derived, or supposed to be derived, and a description sufficient for their identification. In only a few instances, to be referred to directly, is any standard imposed. This is owing to our ignorance of the chemistry of the active ingredients, or to the difficulty or uncertainty of the assay proposed. The only guarantee insisted upon is the mode of collecting. In the case of vegetable drugs this may be from cultivated plants and at definite times of the year. This is due to the fact that at certain times and on certain soils some plants contain more of the active medicinal agent than at other times, or under other conditions.

Thus belladonna has the largest percentage of alkaloids during the time of flowering, and the Pharmacopœia consequently recommends that the fresh leaves and branches (included under *Belladonnæ Folia*) should be 'collected when the plant is in flower.' The most striking case of altered conditions influencing the activity of a plant is that of hemp. Grown in an ordinary way in temperate climates it yields a strong fibre and no medicinal product, whereas cultivated with certain precautions in tropical or sub-tropical countries it yields no fibre of value, but exudes a powerful narcotic resinous substance.



These recommendations of the Pharmacopœia, although tending towards uniformity, are insufficient to procure a uniform product. Drugs of very indifferent quality, or drugs deteriorated by age, may conform to pharmacopœial requirements and yet may contain comparatively little of the active ingredient of the drug. The preparations of crude drugs have indeed been found to vary enormously in pharmacological activity.

In the case of certain active drugs this variability is avoided by **standardising** their preparations. This consists in determining the amount of active ingredients during the making of the preparation, and so adjusting the final product that it shall contain a definite proportion of these. It is applied mainly to preparations containing active alkaloids, and to a few others. It is only partially satisfactory, since in some cases, owing to the difficulty of separating the alkaloids, the preparations are made to contain a certain proportion of 'total alkaloid,' although this may contain varying proportions of several alkaloids, all of them not of equal pharmacological value. In the case of many vegetable drugs so little is known of the active ingredient that standardisation is impossible. In some cases the active principle has been isolated, and it would seem advisable to use this in therapeutics. In other cases the active principle has not been isolated, or it cannot be obtained commercially. In such cases, fortunately few, pharmacological standardisation is alone satisfactory.

#### STANDARDISED PREPARATIONS

The preparations which are standardised, and the preparations made from them which are of necessity standardised, are as follows :

	Percentage of active ingredient
Extractum Opii . . . .	20·00 per cent. morphine
Extractum Opii Liquidum . . . .	·75 per cent. „
Tinctura Opii . . . . .	·75 per cent. „
Linimentum Opii . . . .	·37 per cent. „
Tinctura Opii Ammoniata . . . .	·11 per cent. „
Tinctura Camphoræ Composita	·046 per cent. „

[Opium used for making other (solid) preparations is itself standardised to contain, when dried, 9·5 to 10·5 per cent, of morphine.]

Extractum Belladonnæ Liqui-					
dum	.	.	.	.	·75 per cent. total alkaloids
					of root
Extractum Belladonnæ					
Alcoholicum	.	.	1·0	per cent.	„
Unguentum Belladonnæ			·6	per cent.	„
Emplastrum Belladonnæ			·5	per cent.	„
Linimentum Belladonnæ			·37	per cent.	„
Tinctura Belladonnæ	.		·05	per cent.	„
Suppositoria Belladonnæ	.		$\frac{1}{60}$ gr.		„ in each
Extractum Nucis Vomicae Liqui-					
dum	.	.	.	.	1·5 per cent. strychnine
Extractum Nucis Vomicae			5·0	per cent.	„
Tinctura Nucis Vomicae	.		·25	per cent.	„
Extractum Cinchonæ Liquidum			5·0	per cent. total alkaloids	
Tinctura Cinchonæ	.	.	1·0	per cent.	„
Tinctura Cinchonæ Com-					
posita	.	.	.	·5 per cent.	„
Extractum Ipecacuanhæ Liqui-					
dum	.	.	.	.	2·0 to 2·5 per cent. total
					alkaloids
Acetum Ipecacuanhæ	.		·1	per cent.	„
Vinum Ipecacuanhæ	.		·1	per cent.	„
Tinctura Jalapæ	.	.	1·5	per cent. resin	
Aqua Laurocerasi	.	.	·1	per cent. hydrocyanic	
				acid	

Certain other preparations, *e.g.* Extractum Pareiræ Liquidum which must contain one-quarter of its weight of extractive matter, may also be regarded as standardised preparations, but they are not of sufficient importance to merit consideration here. Preparations containing synthetic substances, such as Spiritus Ætheris Nitrosi which must contain  $1\frac{3}{4}$  to  $2\frac{1}{2}$  per cent. by weight of ethyl nitrite, are not spoken of as being standardised. This term is limited to preparations of crude vegetable drugs.

*The Process of Standardisation.*—The only process of standardisation that need be considered is that of preparations

containing alkaloidal principles. In these preparations a general method is discernible, although the details of the process differ in each instance. This general method depends upon the fact that the alkaloids themselves are practically insoluble in water and soluble in organic solvents, while the salts of the alkaloids are soluble in water and insoluble in most organic solvents. If therefore we make alkaline an aqueous mixture of the drug so as to obtain the alkaloids in the basic form, add an organic solvent insoluble or practically insoluble in water, say chloroform, and shake up in a closed vessel, the alkaloids (and other substances — resins, fats, &c.) are dissolved by the chloroform, and this, on standing, separates from the watery portion, with which it is immiscible. If the chloroform solution be separated and mixed with water to which some acid has been added, and shaken, the alkaloids are converted into alkaloidal salts by the acid, and these, being insoluble in the organic solvent and soluble in the water, go into solution in the latter. The resinous and fatty matters are insoluble in dilute acid, and therefore remain behind in the chloroform. If the aqueous solution be now made alkaline, and shaken up with chloroform, the alkaloids, almost free of extraneous matter, will go into solution, and on allowing the chloroform to evaporate will remain behind as a residue. If a definite amount of the drug or preparation was originally taken, we can obtain the percentage of alkaloids present by drying and weighing this residue. As, however, the residue may not be pure alkaloid, it is usual to titrate this and determine the quantity of base present. This is easily done by dissolving the residue in slight excess of decinormal acid, and determining the uncombined acid by titrating with centinormal alkali.

In practice the process is somewhat more complex than that described. The whole of the alkaloid cannot be extracted from one solution by once shaking with another solution, and therefore this process is generally repeated three times. As an example of the method of standardising preparations the pharmacopœial description for standardising *Extractum Belladonnæ Liquidum* may be taken. 'Introduce 10 cubic centimetres into a separator, add 10 cubic centimetres of chloroform, 50 cubic centimetres of water, and a decided

excess of solution of ammonia; agitate; set aside; separate the chloroformic solution. Twice repeat the agitation with chloroform and the separation. Shake the mixed chloroformic solutions with 5 cubic centimetres of diluted sulphuric acid, mixed with twice its volume of warm water; separate the chloroformic liquid and repeat the agitation with acidulated water. Wash the mixed acid liquids with 3 cubic centimetres of chloroform; then agitate with 10 cubic centimetres of chloroform and an excess of solution of ammonia. Separate the chloroformic solution; twice repeat the agitation with chloroform and the separation; wash the mixed chloroformic solutions with 5 cubic centimetres of water containing one drop of solution of ammonia; draw off the chloroformic layer into a counterpoised dish; evaporate on a water-bath; dry the residue below 100°C.; weigh. Dissolve the residue in 10 cubic centimetres of a decinormal solution of hydrochloric acid and add centinormal solution of soda until the liquid is neutral, using Tincture of Cochineal as an indicator.' The method of calculation is then given.

A similar procedure with certain modifications is used in standardising preparations of *nux vomica* and *ipécacuanha*. In the case of *ipécacuanha*, colouring and other objectionable matter is first precipitated by means of lead subacetate. In standardising liquid extract of *nux vomica*, solution of potassium ferrocyanide is added to the acidulated solution to precipitate the strychnine (brucine being left in the solution). The precipitate after washing is transferred to a percolator, decomposed with solution of ammonia, and the strychnine taken up with chloroform. After separating the chloroformic solution the chloroform is evaporated off and the residual strychnine dried and weighed.

For the preparations of *cinchona*, benzolated amylic alcohol, solution of potassium hydroxide and diluted hydrochloric acid are used. *Cinchona* bark itself is somewhat differently standardised, sodium potassium tartrate being added towards the end of the operation to precipitate the tartrates of quinine and cinchonidine. This separation is necessary, as at least half of the total alkaloids must consist of quinine and cinchonidine.

Opium and its preparations are standardised differently, owing to the difference of solubility of morphine from that of most other alkaloids. Freshly slaked lime and water are added and the whole triturated. The morphine in the filtrate from this, after the addition of ether and a little alcohol, is precipitated by means of ammonium chloride. The precipitate is washed with morphinated water, dried and titrated.



## INORGANIC SUBSTANCES

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### NON-METALS AND THEIR COMPOUNDS

#### WATER

THE only water, apart from the medicated waters already described, recognised by the Pharmacopœia, is distilled water, but any good potable water may be employed in making preparations which are distilled during the process.

**Aqua Destillata.**—Water obtained by distilling any good potable water.

*Characters.*—The Pharmacopœia describes it as ‘colourless, tasteless, and odourless,’ and gives tests to show that it contains not more than traces of dissolved solids or organic matter, no appreciable acid or alkaline substances, and not more than 0.005 part of ammonia per million parts.

*Pharmacology.*—Its action is that of a hypotonic solution (see page 100).

Ordinary water is used for a large number of purposes. It is employed to apply heat or cold, as fomentations, compresses, &c., to certain parts, or as baths to the whole of the body. It is taken internally to dilute the blood when this is overcharged with useless and poisonous products (as in acute and chronic Bright’s disease, gout, and allied conditions), and, by the diuresis it excites, to aid in their elimination. For this purpose distilled water is somewhat better than most natural potable waters.

Large doses of warm water produce nausea and vomiting in many people, and may be used in some circumstances as

an emetic. The sipping of hot water acts as a gastric sedative.

Distilled water is most largely used as a diluent in preparing mixtures, lotions, &c.

## ACIDS

The pharmacological action of acids, *qua* acids, is dependent upon their capacity for being ionised, their capability of neutralising bases, and in some cases their avidity for water and power of coagulating albumen. These various factors are, to some extent, independent.

When acids are dissolved in water they are dissociated into their respective ions. This dissociation varies in the different acids and with the concentration of the solution. (It is also modified by the presence of other substances.)

With moderately weak solutions (about seminormal) the common acids, relative to hydrochloric acid, which is one of the most easily dissociated, assume the following order: hydrochloric and nitric acids, 100; sulphuric acid, 65; ortho-phosphoric acid, 7; tartaric acid, 2; acetic acid, 0.4. With more dilute solutions the numbers gradually approximate until (at about a thousandth normal) they approach uniformity.

The acidity of an acid solution and the astringent effect it produces when applied to tissues are due to the hydrogen-ion; consequently those acids which most easily dissociate in moderately weak solutions possess the most marked astringent action in solutions of the same molecular strength.

The student must be careful to distinguish between molecular and percentage strengths. Solutions of the same percentage strength of ordinary commercial acids do not follow the order given above either as regards acidity or astringency. Apart from the difference in molecular weight, the commercial acids vary considerably in the percentage of pure acid they contain. Thus commercial sulphuric acid contains 98 per cent. of hydrogen sulphate, and hydrochloric acid 32 per cent. of hydrogen chloride; hence in equal percentage solutions the former acid, notwithstanding its inferior dissociability, is the more powerful acid of the two.

The pharmacological action of a solution of an acid, however, like all other substances which dissociate in solution, is dependent on both (or all) its ions. If the anions have little

pharmacological action (as sulphate-ion) the action of the hydrogen-ion preponderates, and a pure or almost pure acid action results. If, however, the anions are pharmacologically active, the acid action becomes less important, and, as in the case of hydrocyanic acid (which, however, dissociates only to a slight degree) may become negligible. But whatever the acid may be (excluding a few cases in which there is a modifying anion) the same number of hydrogen-ions in the same amount of solution always exert the same local astringent action if applied under the same conditions. The local astringent action of most acid solutions, in other words, is due to the hydrogen-ions they contain.

This power of dissociation (and the local astringent action) must not be confounded with the ability of acids to neutralise bases. This action, it is true, is dependent on the hydrogen-ions neutralising the hydroxyl-ions of the base; but in the case of organic acids, for example, the degree of dissociation of which is small, the hydrogen-ions in solution are comparatively few. As these are neutralised, however, more hydrogen-ions are liberated, and neutralisation continues until the hydrogen-ions of the acid, or the hydroxyl-ions of the base, are satisfied. Such acids, therefore, may possess comparatively little astringency, but considerable power of neutralising bases.

The pharmacopœial acids may be divided into

(a) Acids possessing an almost pure acid character, *i.e.* acids containing innocuous anions. And these may be further subdivided into

(i.) inorganic acids which are easily dissociated and hence exert a powerful acid action.

Sulphuric acid, nitric acid, hydrochloric acid, nitro-hydrochloric acid, phosphoric acid. Chromic acid, although possessing other actions, is most closely associated with this group.

(ii.) Organic acids, less easily dissociated, hence weaker. Glacial acetic acid, acetic acid, lactic acid, tartaric acid, tannic acid, gallic acid.

(b) Acids with anions possessing a specific effect. Boric acid, benzoic acid, salicylic acid, sulphurous acid (all anti-septic) ; hydrobromic acid (possessing a depressant action on the nervous system) ; hydrocyanic acid and arsenious acid (powerfully poisonous and possessing scarcely any acid action). [Carbolic acid, being a phenol, will be considered later (p. 234).]

(c) Acids insoluble in water, hence remaining undissociated in it. They consequently possess no astringent action. Oleic acid is the only one official.

The common inorganic acids of the British Pharmacopœia are clear, colourless, or almost colourless liquids. As already stated, they differ considerably in strength of pure acid. The dilute forms of the commercial acids (*acida diluta*), however, are made of approximately the same acid strength (1 gramme requiring for neutralisation 2 to 3 c.c. normal NaOH) ; therefore their dose is the same. When neutralised, all acids give the test for the anion. They should contain no metallic impurities (lead, arsenic, copper, &c.), and no other negative radicles except traces of some which are incidental to their preparation. The liquid inorganic acids, except phosphoric acid which is converted into meta-phosphoric acid, should yield no residue on evaporation.

*Pharmacological action of an acid* [group (a)]. Applied to mucous membranes or denuded surfaces, dilute acid solutions act as astringents, *i.e.* they draw together the superficial tissue by neutralising the alkalinity of the cells and secretions and modifying their albuminous contents. This is accompanied by transient smarting pain owing to irritation of the sensory nerve-endings. Under the astringed layer the tissues are irritated to a greater or less degree, and more or less so-called 'reaction' (increased blood-supply, &c.) is set up. Continued application of weak solutions, or the application of a stronger solution, causes sufficient irritation to produce inflammation. The action of most official organic acids does not pass beyond this stage. The concentrated inorganic



acids (except phosphoric acid) have a more powerful action. They precipitate albumen, abstract water from the tissues on account of their affinity for this substance, and thereby act as caustics. In most cases the precipitated albumen is soluble in excess of acid, and therefore these acids tend to produce a somewhat diffuse effect. During diffusion they are gradually neutralised by the albumen and the alkalinity of the tissues, and their effect terminates in an irritant action on the underlying parts.

Applied to the skin, weak acid solutions have a very mild astringent action, strong acids a limited caustic action.

When taken by the mouth, weak acids exert an astringent effect on the mucous membrane and ‘edge the teeth.’ They have a characteristic acid taste and produce reflex salivation. In the stomach they increase the acidity (or diminish the alkalinity) of the gastric contents, but produce no other noteworthy action. To the upper part of the intestinal tract they act as stimulants and increase the various secretions. They are neutralised and absorbed mainly as the corresponding alkali salts. Their further action is that of a saline and is unimportant.

As their neutralisation in the intestine absorbs bases which would otherwise increase or maintain the alkalinity of the blood, the blood tends to become less alkaline and the urine more acid. This effect is seen in herbivorous animals, but is much less evident in carnivores and man owing to a regulating mechanism of the tissues.

Large quantities of dilute acids are liable to irritate the stomach, producing ‘heartburn,’ and they may irritate the intestine and cause diarrhœa. Even small quantities taken repeatedly cause indigestion. The strong acids taken in a concentrated form produce symptoms of corrosive poisoning.

Weak acids are applied to the skin to check excessive sweating. They are taken internally as refreshing drinks in fever and other conditions, and are given to aid digestion when the acid of the gastric juice is insufficient for this purpose. With the exception of nitric acid, which is a powerful caustic, and lactic and glacial acetic acids, which are mildly caustic, the concentrated acids are not employed therapeutically.

## SULPHURIC ACID

**Acidum Sulphuricum.**—An acid containing ‘about 98 per cent. by weight of hydrogen sulphate,  $\text{H}_2\text{SO}_4$ .’

Prepared by the action of nitrogen peroxide and aqueous vapour on the sulphur dioxide produced by the burning of sulphur or pyrites in air. The reactions are somewhat complex.

*Characters.*—A colourless, intensely acid liquid of oily consistence, powerfully corrosive, with a marked affinity for water.

Specific gravity 1·843. It should contain no selenium, which sometimes occurs with sulphur in pyrites, or other impurity.

*Pharmacology.*—It is a powerful caustic, and, on account of its affinity for water, often chars tissues. It is not employed therapeutically.

**Acidum Sulphuricum Dilutum.**—Contains 13·65 per cent. by weight of hydrogen sulphate,  $\text{H}_2\text{SO}_4$ .

Sulphuric acid, 82·7 c.c., is added to sufficient distilled water to make, at 15·5°C., 1,000 c.c. of product.

One gramme should require for neutralisation  $2\cdot8 \text{ c.c. } \frac{\text{N}}{1} \text{ NaOH}$ .  
It is contained in **Infusum Rosæ Acidum**.

*Dose.*—5 to 20 minims.

*Pharmacology.*—Its action is that of a moderately strong acid solution. It is believed by some to exert an astringent action on the intestine, and has therefore been used (with tincture of opium) in the treatment of diarrhœa. Diluted, in the form of so-called ‘sulphuric acid lemonade,’ it has been employed in lead works to convert the lead or lead compounds accidentally swallowed into the slightly soluble lead sulphate and thus diminish the tendency to lead poisoning. Cleanliness is a more efficient remedy.

**Acidum Sulphuricum Aromaticum.**—An alcoholic solution containing aromatic substances (ginger and

cinnamon) and possessing, approximately, the same acid strength as diluted sulphuric acid.

Prepared by adding 3 fl. oz. of sulphuric acid gradually to  $29\frac{1}{2}$  fl. oz. of alcohol (90 per cent.), then  $\frac{1}{2}$  fl. oz. of spirit of cinnamon, and 10 fl. oz. of tincture of ginger.

A small quantity of ethyl hydrogen sulphate is formed by the interaction of the sulphuric acid and alcohol.

The neutralising power is equivalent to 13.8 gr. of  $\text{H}_2\text{SO}_4$  in 100 gr.

It is contained in **Infusum Cinchonæ Acidum**.

*Dose*.—5 to 20 minims.

*Pharmacology*.—Its action and uses are similar to those of diluted sulphuric acid. On account of the aromatic substances and alcohol it contains, it is more agreeable and carminative, and is consequently often preferred to the simpler acid. It is used mainly in the treatment of diarrhœa.

#### NITRIC ACID

**Acidum Nitricum**.—‘A liquid containing 70 per cent. by weight of hydrogen nitrate,  $\text{HNO}_3$ , and 30 per cent. of water.’

Prepared by distilling a mixture of sulphuric acid and sodium nitrate.

*Characters*.—A colourless, strongly acid liquid, giving off brownish, powerfully irritating fumes.

Specific gravity 1.42. It should boil constantly at  $121^\circ\text{C}$ . and distil with uniform composition. It should contain no metallic or other impurities. Bromates and iodates mentioned by the Pharmacopœia as possible impurities may arise from the bromides and iodides in the crude sodium nitrate used in its manufacture.

*Pharmacology*.—It is a powerful caustic. Although a weaker acid with less affinity for water than sulphuric acid, it is a more powerful precipitant of albumen, and the precipitated albumen is insoluble in excess of the acid. Its caustic action is therefore more localised than that of other acids. It is used for cauterising warts and other abnormal growths. The cauterised part (the eschar) has a yellowish colour, which is deepened by ammonia (xanthoproteic reaction).

**Acidum Nitricum Dilutum.**—Contains 17·44 per cent. by weight of hydrogen nitrate,  $\text{HNO}_3$ .

Add to 193·2 c.c. of nitric acid sufficient distilled water to make, at  $15\cdot5^\circ\text{C}$ ., 1,000 c.c.

One gramme requires for neutralisation  $2\cdot7$  c.c.  $\frac{\text{N}}{1}$  NaOH.

*Dose.*—5 to 20 minims.

*Pharmacology.*—Its action is that of a moderately strong acid solution. It has been used in the treatment of diseases of the liver and certain other ailments, but is of doubtful value. Diluted, it has been employed as a lotion for itching and other skin affections.

**Acidum Nitro-hydrochloricum Dilutum.**—Described as ‘an aqueous solution of free chlorine, hydrochloric, nitric, and nitrous acids.’ It would be more correctly defined as an aqueous solution of nitric and hydrochloric acids containing traces of free chlorine and nitrous acid.

Prepared by mixing nitric acid, 3 fl. oz.; hydrochloric acid, 4 fl. oz.; distilled water, 25 fl. oz.; and storing in a glass-stoppered bottle for 14 days before using. Practically no change occurs during that time.

*Characters.*—A colourless acid liquid with a slight pungent odour.

One gramme requires for neutralisation about  $2\cdot5$  c.c.  $\frac{\text{N}}{1}$  NaOH.

*Dose.*—5 to 20 minims.

*Pharmacology.*—Its action is an acid action, and merely that of the individual acids composing it. These acids, if pure when mixed, do not interact on one another, and consequently chlorine and nitrous acid are not formed in any appreciable amount, and therefore can exert no pharmacological action. The acid has been largely used, both externally and internally, in the treatment of hepatic affections, syphilis, and other diseases; but whatever benefit may have occurred ought to have been obtained by the use of nitric acid alone.



## HYDROCHLORIC ACID

**Acidum Hydrochloricum.**—‘A liquid containing 31·79 per cent. by weight of hydrogen chloride, HCl, and 68·21 per cent. of water.’

Prepared by distilling a mixture of sulphuric acid and sodium chloride and dissolving the gas thus obtained in water.

*Characters.*—A colourless, strongly acid liquid, giving off white pungent fumes in moist air.

Specific gravity 1·160. It should contain no free chlorine or other impurity.

*Pharmacology.*—It possesses caustic properties, but is rarely used.

**Acidum Hydrochloricum Dilutum.**—Contains 10·58 per cent. of hydrogen chloride, HCl.

Add to 301·8 c.c. of hydrochloric acid sufficient distilled water to make, at 15·5°C., 1,000 c.c.

One gramme requires for neutralisation  $2\cdot9 \text{ c.c. } \frac{N}{1} \text{ NaOH.}$

It is contained in *Injectio Apomorphinæ Hypodermica.*

*Dose.*—5 to 20 minims.

*Pharmacology.*—It has a pure acid action. Being the normal acid of the gastric juice, it is given whenever there is reason to believe that the gastric juice is deficient in acidity. It is mostly used, combined with bitters, in cases of atonic dyspepsia and other chronic gastric affections.

**Acidum Nitro-hydrochloricum Dilutum.** — (See page 63).

Hydrochloric acid is also contained in *Glycerinum Pepsini.*

## PHOSPHORIC ACID

**Acidum Phosphoricum Concentratum.**—‘A liquid containing 66·3 per cent. of hydrogen ortho-phosphate,  $\text{H}_3\text{PO}_4$ , with 33·7 per cent. of water.’

Prepared, for medicinal purposes, from phosphorus, by burning it in air, dissolving the oxides formed in water containing nitric acid, and evaporating to a syrup; or by boiling it with fairly strong nitric acid in a reflux condenser.

*Characters.*—A colourless acid liquid of syrupy consistence.

Specific gravity 1·5. It should contain no metallic or other impurities, except traces of iron and sulphates. Tests are given in the Pharmacopœia to prove the absence of meta- and pyro-phosphoric acids, phosphorous acid, and silica. On evaporation it yields meta-phosphoric acid which on cooling forms a glass-like mass.

*Pharmacology.*—It has the action of a moderately strong acid solution. This is due to its small dissociation constant, its slight affinity for water, and its inability to precipitate albumen. It is not used, undiluted, therapeutically.

**Acidum Phosphoricum Dilutum.**—A liquid containing by weight 13·8 parts of hydrogen ortho-phosphate,  $\text{H}_3\text{PO}_4$ , and 86·2 parts of water.

Dilute 150 c.c. of concentrated phosphoric acid with sufficient distilled water to form, at  $15\cdot5^\circ\text{C}$ ., 1,000 c.c.

One gramme mixed with 0·5 g. lead oxide should leave, after evaporation and heating to dull redness, a residue weighing 0·6 g.

*Dose.*—5 to 20 minims.

*Pharmacology.*—Its action is similar to, but somewhat weaker than, that of the previous diluted acids. It is believed to be less injurious to the stomach. In the intestines it is converted into alkaline phosphates, which are absorbed and act as such. It has been used to quench the thirst of febrile and diabetic patients, and to acidify or increase the acidity of the urine. For the latter purpose it is not of much value.

## CHROMIC ANHYDRIDE

**Acidum Chromicum.**— $\text{CrO}_3$ . It becomes chromic acid when dissolved in water.

Prepared by adding an excess of sulphuric acid to a strong solution of potassium bichromate, washing and drying the crystals which separate.

*Characters.*—Crimson acicular crystals, inodorous, very deliquescent (probably owing to traces of sulphuric acid, since the pure anhydride is not deliquescent). Soluble in less than its own weight of water.

It melts at  $192^{\circ}\text{C}.$ , and at higher temperatures decomposes into oxygen and chromic oxide,  $\text{Cr}_2\text{O}_3$ , a greenish-black substance insoluble in water. On account of the ease with which it parts with oxygen it is a powerful oxidising agent, and when mixed with small portions of readily oxidisable substances (alcohol, ether, glycerin, dry organic matter generally) rapid combustion, often with explosion, occurs. It should contain no impurities except traces of sulphates.

*Pharmacology.*—Its action depends on its acid properties, its oxidising power, and, in part, on its being a compound of a heavy metal. It is an antiseptic. It coagulates albumen and has an affinity for water, and hence is caustic. Its caustic action, like nitric acid, is almost limited to the point of application. The skin is stained a yellowish brown. It is usually employed in the form of the official solution.

**Liquor Acidi Chromici.**—‘An aqueous solution containing the equivalent of 25 per cent. of chromic anhydride,  $\text{CrO}_3$ , or 29.5 per cent. of chromic acid regarded as  $\text{H}_2\text{CrO}_4$ .’

Dissolve 1 oz. of chromic anhydride in 3 fl. oz. of distilled water.

*Characters.*—An orange-red liquid, inodorous, strongly acid.

*Pharmacology.*—It is used as a caustic to destroy small growths and infective ulcers. Being inodorous it may be applied to the larynx. It has also been used, well diluted, to harden the skin and stop excessive sweating, and as an application to discharging mucous surfaces.

## ORGANIC ACIDS

The official organic acids are much weaker than the inorganic acids on account of their smaller dissociation. The fatty acids also differ from the inorganic acids in undergoing

decomposition after absorption, as salts, into the blood. The extent of the decomposition varies in the different acids, but in all cases the decomposition is the same in kind. The products are carbon dioxide (or carbonate) and water. As they are excreted in part as carbonates, they diminish the acidity of the urine and may even make it alkaline.

## ACETIC ACID

Glacial and the ordinary commercial acetic acids are official.

**Acidum Aceticum Glaciale.**—An acid containing 99 per cent. by weight of hydrogen acetate,  $\text{CH}_3\cdot\text{COOH}$ .

Prepared by distilling a mixture of sulphuric acid and dry sodium or calcium acetate.

*Characters.*—Above  $15\cdot5^\circ\text{C}$ . it is a clear colourless liquid, strongly acid, with a characteristic pungent odour. When cooled it crystallises, and during the winter months in this country it is usually seen in the crystalline condition.

It should remain crystalline until the temperature rises above  $15\cdot5^\circ\text{C}$ . (pure acetic acid melts at  $16\cdot7^\circ\text{C}$ .). It should contain no metallic or other impurity. The specific gravity (1·058) increases on the addition of water until an acid containing 77 per cent.  $\text{CH}_3\cdot\text{COOH}$  (corresponding to  $\text{CH}_3\cdot\text{COOH} + \text{H}_2\text{O}$ ) is obtained, after which the further addition of water causes a fall. An acid containing 46 per cent.  $\text{CH}_3\cdot\text{COOH}$  has the same specific gravity as glacial acetic acid, but in this case the further addition of water causes a fall in the specific gravity.

It is contained in **Acetum Cantharidis**, and **Linimentum Terebinthinæ Aceticum**.

*Pharmacology.*—It is a mild caustic, and is sometimes used for removing warts and similar growths.

**Acidum Aceticum.**—A liquid containing 33 per cent. by weight of hydrogen acetate,  $\text{CH}_3\cdot\text{COOH}$ , and 67 per cent. of water.

It is a product of the destructive distillation of wood (see page 536). It may also be obtained by the oxidation of ethylic alcohol, but this method is used mainly in making vinegar.



*Characters.*—A clear colourless acid liquid, with a characteristic pungent odour.

Specific gravity 1·044. It should yield no characteristic test for formates, or metallic or other impurities, and should contain not more than a trace of empyreumatic matter.

*Pharmacology.*—It has the actions of a moderately powerful acid, but, therapeutically, is rarely employed, undiluted. It is occasionally used for troublesome ringworm.

**Acidum Aceticum Dilutum.**—An aqueous solution containing 4·27 per cent. by weight of hydrogen acetate,  $\text{CH}_3\cdot\text{COOH}$ .

Add to 124·7 c.c. of acetic acid sufficient distilled water to produce 1,000 c.c.

One gramme requires for neutralisation  $7\cdot1 \text{ c.c. } \frac{\text{N}}{10} \text{ NaOH}$ .

Good vinegar is of about the same strength.

It is contained in **Acetum Ipecacuanhæ**, **Acetum Scillæ**, and **Liquor Morphinæ Acetatis**.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—Its action is that of a dilute acid. It is much weaker than the diluted mineral acids, and is more rarely given internally. It has a characteristic taste, and, after absorption from the intestine as acetates, is broken up to a large extent in the blood. A mixture of vinegar and water is sometimes sponged over the skin to diminish excessive sweating.

**Oxymel.**—Consists approximately of acetic acid 1, clarified honey 8, distilled water 1 (see page 34). It contains about 3 per cent. of hydrogen acetate.

*Dose.*—1 to 2 fluid drachms.

*Pharmacology.*—It is mainly demulcent. The small amount of acetic acid produces a mild astringent effect. It may be given to children to allay the irritability of a sore throat.

**Oxymel Scillæ.**—See page 363.

## LACTIC ACID

**Acidum Lacticum.**—‘A liquid containing 75 per cent. of hydrogen lactate,  $\text{CH}_3\cdot\text{CHOH}\cdot\text{COOH}$ , with 25 per cent. of water.’

*Characters.*—A colourless, syrupy liquid with an acid taste, but without odour. It absorbs moisture when exposed to the air. It is miscible in all proportions with water, alcohol, and ether, but is only slightly soluble in chloroform. (Chloroform is slightly soluble in lactic acid.)

Specific gravity 1.21. Tests are given in the Pharmacopœia to prove the absence of sarco-lactic acid, sugars, lead, and other likely impurities.

The official acid is the optically inactive form.

*Pharmacology.*—It is mildly caustic to denuded and mucous surfaces. It is used chiefly to destroy tuberculous ulcerations of the pharynx and larynx.

## TARTARIC ACID

**Acidum Tartaricum.**—*d*-Di-hydroxy-succinic acid.



It is prepared from acid potassium tartrate, usually from the crude form, argol, which is deposited in wine-casks during the fermentation of grape juice. This is boiled with chalk and water, calcium chloride is added to decompose potassium tartrate, and the calcium tartrate obtained after washing is decomposed with dilute sulphuric acid.

*Characters.*—Large colourless monoclinic prisms, with an agreeable strongly acid taste. Soluble in less than its own weight of water, in  $2\frac{1}{2}$  of alcohol (90 per cent.), and in  $4\frac{1}{2}$  of glycerin.

It should contain not more than traces of calcium and sulphates and no lead or other impurity.

It is contained in all effervescing preparations and in *Pilula Quininae Sulphatis*.

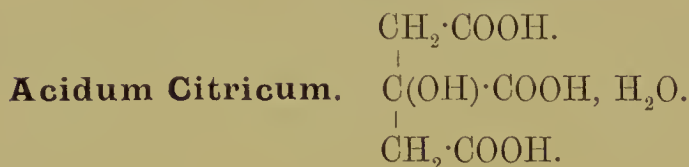
*Dose.*—5 to 20 grains.

*Pharmacology.*—It has the action of a moderately strong acid. The tartrate into which it is converted in the

intestine is less readily absorbed than acetates, and consequently in moderately large doses tartaric acid produces diarrhœa. The tartrate absorbed into the blood is decomposed, but to a less extent than acetates. It may cause slight diuresis.

It is employed principally to make drinks for febrile and diabetic patients and as an ingredient of effervescing preparations.

#### CITRIC ACID



It is contained in the juice of many fruits, but is prepared usually from lemon juice. After boiling and filtering to free it from albumen &c., the juice is boiled with chalk, and the precipitated calcium citrate is decomposed with sulphuric acid.

*Characters.*—Large colourless trimetric prisms with an agreeable strongly acid taste. Soluble in less than its weight of cold water, in less than twice its weight of alcohol (90 per cent.), in 2 of glycerin, and slightly in ether.

It should contain only traces of calcium and sulphates, and no tartaric acid, lead, or other impurity. It is an ingredient of effervescing preparations.

A solution containing 35 grains in 1 oz. of water, resembles, in acidity, an average specimen of lemon juice.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Its action is similar to that of tartaric acid, except that citrates are more readily absorbed and somewhat more completely decomposed in the blood than tartrates. It has a pleasanter taste than tartaric acid, and is generally preferred to this. It is used for the same purposes.

#### OLEIC ACID

**Acidum Oleicum.**— $\text{CH}_3(\text{CH}_2)_7\text{CH}:\text{CH}(\text{CH}_2)_7\text{COOH}$  or  $\text{C}_{17}\text{H}_{33}\text{COOH}$ . Usually not quite pure.

It is separated from the mixed acids obtained by saponifying or hydrolysing fixed oils and fats by repeatedly subjecting the cooled mixture to pressure. A better product is obtained by saponifying almond oil (which is almost pure olein) with lead oxide, separating the lead oleate from impurities by dissolving it in ether and afterwards decomposing it with a mineral acid.

*Characters.*—When pure, a colourless and odourless liquid without action on litmus, insoluble in water, but soluble in alcohol, ether, or chloroform. The commercial product is usually a straw-coloured liquid with a faintly rancid smell and a slight acid reaction. On exposure to air it becomes more rancid and darkens in colour. The rancid smell and the acid reaction are due to the presence of lower fatty acids. On cooling to 5°C. it becomes semi-solid; it liquefies again at about 14°C.

Specific gravity 0.890 to 0.910. It should contain not more than traces of palmitic or stearic acid.

*Pharmacology.*—Being insoluble in water it has merely a protective and emollient action when applied to the skin. Taken internally it is absorbed as oleates which are decomposed in the blood. It is used mainly to make alkaloidal and metallic oleates for external use as ointments. (The two official metallic oleates are made by double decomposition.)

## ACIDS WITH SPECIAL ACTIONS

Of these, hydrobromic, arsenious, benzoic, salicylic, gallic, and tannic acids are more conveniently considered elsewhere.

### BORIC ACID

**Acidum Boricum.**—Boracic acid,  $H_3BO_3$ .

Prepared by purifying native boric acid, or by the interaction of sulphuric or hydrochloric acids and solutions of borax.

*Characters.*—Colourless pearly laminae, unctuous to the touch. It has a feebly acid and bitter taste, with a sweetish after-taste. Soluble 1 in 30 of water (12°C.), 1 in 3 of



boiling water, 1 in 4 of glycerin, 1 in 30 of alcohol (90 per cent.).

A cold saturated solution changes litmus to a wine-red, a hot saturated solution to a bright red colour. It gives a characteristic reaction with turmeric paper, and an alcoholic solution of it burns with a green flame. On heating, it is converted to a brittle glass-like mass (boric anhydride). It may contain slight traces of iron and other common impurities, but no lead or copper compounds.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It is dissociated to a very slight extent in aqueous solution, and is consequently a very weak acid; it is therefore very feebly astringent. It is mildly antiseptic; and, applied in the form of powder, is also protective and drying on account of its comparative insolubility. It is used mainly as a preservative (for milk, butter, &c.); as a mild antiseptic lotion (in wound treatment, for diseases of the eye, for washing out the bladder, &c.); and as a dusting powder (under splints, for sweating of the feet, &c.) When given internally it produces no obvious effects in ordinary doses, but if frequently administered for long periods it may produce cutaneous eruptions and other symptoms. Large doses cause digestive, nervous, and renal symptoms, and may produce cutaneous eruptions after a short interval. These effects have been obtained by washing out large cavities with large quantities of a saturated solution. Boric acid is excreted, mainly in the urine, unchanged and as borates. It has been given internally to diminish the putridity of the urine of chronic cystitis.

**Unguentum Acidi Borici.**—Consists of boric acid 1, white paraffin ointment 9.

*Pharmacology.*—It is a mild antiseptic ointment, and is used largely in the treatment of small wounds. It is sometimes used as a dressing for large burns, but for this purpose it requires diluting, as it is somewhat irritant.

**Glycerinum Acidi Borici.**—Contains 6 parts of boric acid in 20 parts, by weight. It is a solution of glyceryl borate in glycerin. The borate tends to separate after standing some time. On dissolving in water, boric acid is re-formed (see page 26).

*Pharmacology.*—It is antiseptic and stimulating. It may be used as a paint to the throat, and as a preservative. Since glycerin aids the solution of boric acid, it may be used to obtain a stronger lotion than can be prepared from boric acid and water alone.

## SULPHUROUS ACID

**Acidum Sulphurosum.**—‘An aqueous solution containing 6·4 per cent. of hydrogen sulphite,  $\text{H}_2\text{SO}_3$ , corresponding to 5 per cent. by weight of sulphurous anhydride,  $\text{SO}_2$ .’

*Characters.*—A colourless liquid smelling of sulphur dioxide. It is unstable, being readily oxidised to sulphuric acid.

It should contain only traces of sulphates. It is estimated volumetrically with solution of iodine.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Owing mainly to its reducing action it is powerfully antiseptic. It is used in the treatment of certain parasitic skin diseases, and, although to a less extent than sodium sulphite, in gastric fermentation. It has a characteristic sulphurous smell, and an acid, somewhat unpleasant, taste. In the stomach it is oxidised, when given in ordinary doses, to sulphuric acid, and is absorbed from the intestine as sulphates. Consequently it exerts no antiseptic action in the blood.

It is used, in the form of burning sulphur, to disinfect rooms. The sulphur dioxide thus produced is only disinfectant in the presence of water, *i.e.* when sulphurous acid is formed.

## HYDROCYANIC ACID

**Acidum Hydrocyanicum Dilutum.**—‘An aqueous solution containing 2 per cent. by weight of hydrogen cyanide,  $\text{HCN}$ .’

Prepared by distilling a mixture of dilute sulphuric acid and potassium ferrocyanide. The end-reaction may be represented as follows:



*Characters.*—A colourless, volatile, slightly acid liquid, with a characteristic odour.

Specific gravity 0.997. It should contain only traces of sulphates or chlorides. It is estimated volumetrically by solution of silver nitrate (half-precipitation process).

As it readily volatilises and also undergoes decomposition into ammonium formate, it should be kept in small well-stoppered coloured bottles, inverted, in a dark place.

It is contained in **Tinctura Chloroformi et Morphinæ Composita**.

*Dose.*—2 to 6 minims.

*Pharmacology.*—It is powerfully poisonous. It inhibits the vital processes of all forms of life; but, as the lower organisms can bear this with impunity for some time, it is not antiseptic. In the higher animals it is rapidly absorbed into the blood, and in large doses quickly inhibits the vital activity of cells, including the cells of the respiratory centre, hence death rapidly occurs.

After very large doses (1 ounce or more) symptoms develop almost immediately; the individual falls back in a convulsive stretch, often with a scream, and death occurs in a few minutes. After small poisonous doses (about 90 minims) the characteristic unpleasant acrid taste is first experienced, and is quickly followed by a sense of oppression in the chest, anxiety, slow and laboured respiration, slow or rapid pulse, headache and giddiness. Asphyxial symptoms, and later unconsciousness and convulsions, develop, and death occurs in 20 to 50 minutes. If the patient live over an hour recovery is probable, owing partly to the rapid excretion of hydrocyanic acid and partly to its conversion into innocuous compounds in the tissues. The blood in the veins in cyanide poisoning is usually arterial in hue, because, owing to the inhibited vitality of the tissues, it has not been reduced. Hence the mucous membranes usually present a bright red appearance.

It acts locally as a sedative. Applied to the skin in moderately dilute solutions (1 in 20) it depresses the nerve-endings and relieves irritation, and when taken internally in full pharmacopœial doses it diminishes gastric pain and

other symptoms arising from irritation of the stomach. It is used to relieve the itching of urticaria, lichen, &c., and to allay the vomiting and pain of gastric disease.

After absorption into the blood small doses transitorily stimulate the respiratory centre and act as a sedative to the bronchial mucous membrane. It is given to allay cough, especially the dry irritable cough of phthisis, both as a mixture and as an inhalation.

Hydrocyanic acid is a product of the interaction of a glucoside and a ferment occurring in certain vegetable drugs (bitter almonds, cherry-laurel leaves, and Virginian prune bark) when these are treated with water. The action of these drugs is almost solely due to the hydrocyanic acid they yield (see page 364). Apricot, cherry, and other seeds undergo a similar decomposition.



## NON-METALLIC ELEMENTS

ONLY four of these are official as such in the Pharmacopœia, viz. iodine, carbon, sulphur, and phosphorus; but as oxygen is the active factor in the action of hydrogen peroxide, this substance will be included here. Chlorinated lime is also conveniently considered with this group.

## OXYGEN

Oxygen, although largely used in therapeutics, is not official. The Pharmacopœia contains no substances which are gaseous under ordinary conditions, since these cannot be sold in the ordinary way, and hence do not require official restrictions. All oxidising agents owe part of their activity to the oxygen they liberate, but hydrogen peroxide owes all its activity to this element.

**Liquor Hydrogenii Peroxidi.**—An aqueous solution of hydrogen peroxide,  $H_2O_2$ , capable of yielding 9 to 11 volumes of oxygen.

Prepared by adding hydrated barium peroxide to a dilute mineral acid, usually phosphoric, silico-fluoric, or sulphuric.

*Characters.*—A colourless, odourless, mobile liquid, giving a sensation of frothiness when taken into the mouth. It has a slightly acid taste owing to the presence of a small amount of acid as a preservative. On heating, it decomposes into water and oxygen.

A few drops added to a dilute solution of potassium chromate acidified with sulphuric acid form perchromic acid, which, on extraction with ether, gives to it a blue colour. Treated with solution of potassium permanganate and sulphuric acid it gives off oxygen, which, if collected, will suffice to standardise the solution. The strength of the liquor is

usually given in terms of volumes of oxygen produced by one volume of liquor.

It should contain no compounds of barium or of fluorine.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—Its action is wholly dependent on the ease with which it decomposes into oxygen and water. All living tissues immediately decompose it. On account of its oxidising properties it is a powerful, though transient, disinfectant, and is used almost solely as such. It may be employed in wound treatment generally, but should not be injected into closed cavities, since the rapid evolution of oxygen has led to serious symptoms, and even death, owing to absorption of the oxygen and the production of air-embolism. For the same reason it can be given hypodermically or intravenously only in small quantities. It has been recommended in cyanide poisoning.

## IODINE

**Iodum.**—‘A solid non-metallic element.’

Prepared from kelp—the ashes of certain sea-weeds—and from the sodium iodate contained in the mother liquor of Chili saltpetre after crystallisation of the sodium nitrate.

*Characters.*—Usually in crystalline laminae of a violet-black colour, with a metallic lustre and a sharp irritating odour. It sublimes at ordinary temperatures, and if gently warmed gives off a violet-coloured vapour. Soluble 1 in about 5,000 of water, readily soluble in solutions of potassium iodide, in alcohol, ether, and most organic solvents.

It gives, even in excessively small amounts, a characteristic blue colour with a cold dilute mucilage of starch.

It should not contain any iodine cyanide which is liable to be formed during the combustion of sea-weed owing to the presence of alkaline substances and organic matter.

**Liquor Iodi Fortis.**—Contains nearly 1 ounce of iodine in 8 fluid ounces.

Iodine, 5 oz.; potassium iodide, 3 oz.; distilled water, 5 fl. oz.; alcohol (90 per cent.), 36 fl. oz.

*Pharmacology.*—It is a powerful irritant. Applied to the skin, it immediately stains it a deep brown. It penetrates fairly readily, and if applied in sufficient amount irritates the underlying tissues and produces a feeling of heat and prickling. After a few applications marked tenderness results. It may be absorbed from the skin to a slight extent.

It is used (generally diluted) in the treatment of glandular enlargements, particularly of tuberculous glands, and chronic inflammations of serous membranes. It acts mainly as a mild counter-irritant.

It is a powerful antiseptic, but is rarely used for this purpose.

**Tinctura Iodi.**—Contains 1 ounce of iodine in 40 fluid ounces.

Iodine, 1 oz.; potassium iodide, 1 oz.; distilled water, 1 fl. oz.; alcohol (90 per cent.), to make 40 fl. oz.

*Dose.*—2 to 5 minims.

*Pharmacology.*—Externally it has a similar action to the strong solution but weaker. It may be mixed with the latter for general use, but it is sufficiently powerful for applying to the skin of children.

When taken internally, even if well diluted, it possesses an extremely unpleasant taste, and in full doses is not generally well borne by the stomach. It is probably absorbed in the main as iodides, but the amount which can be given by the mouth is too small to exert a beneficial iodide action.

It is used mainly for the same purposes as the strong liquor. It is sometimes painted on chronic skin affections such as ringworm; and has been given internally, in small doses, in the troublesome vomiting of pregnancy, and other conditions, but it is of little value.

**Unguentum Iodi.**—Contains 1 of iodine in 25 by weight.

Iodine, 1; potassium iodide, 1; glycerin, 3; lard, 20.

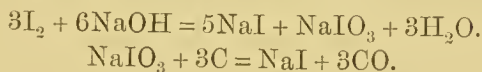
*Pharmacology.*—Its action and uses are similar to those of the strong liquor. It is weaker both on account of the smaller percentage of iodine and because this is combined with a fatty basis.

## IODIDES

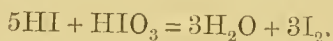
Most of the iodides are active in virtue of the combined iodine they contain, *i.e.* in virtue of their iodide-ion. This is pre-eminently the case with the alkaline iodides, but in the iodides of the heavy metals the action of the iodide-ion is more or less masked by the more powerful effect of the kation (metallic ion). Thus the iodides of arsenic and mercury when taken internally produce the effect of the arsenium-ion and mercury-ion respectively. Consequently they are best considered later. Lead iodide, however, is only employed externally, and, so used, its action is similar to that of a weak iodine preparation. It will therefore be considered here.

**Sodii Iodidum**—NaI.

Prepared by adding a slight excess of iodine to a solution of sodium hydroxide, evaporating to dryness, decomposing the sodium iodate formed by fusing the mixture with charcoal, dissolving in water, filtering, and crystallising at a temperature above 65°C. (The Pharmacopœia gives 20°C.)



It is important to remove the iodate because in presence of acids, hydriodic and iodic acids are formed from the mixture, and these decompose one another and produce free iodine.



This reaction would occur in the stomach, and the iodine liberated would produce serious irritation.

If the salt is crystallised below 65°C. a hydrated salt, NaI,2H<sub>2</sub>O, is produced.

*Characters.*—Small white cubical crystals or a dry white micro-crystalline powder, with a saline and slightly bitter taste. It deliquesces on exposure to moist air. Soluble in less than its weight of water, in 2½ parts of alcohol (90 per cent.), and in 1 part of glycerin.



It should not contain more than 5 per cent. of water. (It frequently contains more than this, owing probably to the error in the temperature given in the mode of preparation.) Minute traces of bromides, chlorides, and sulphates are allowed.

*Dose.*—5 to 20 grains.

*Pharmacology.*—The action of the iodides is ill-understood. Locally, sodium iodide exerts, in the main, a saline effect, but it is not used for this purpose. It is quickly absorbed from the stomach and intestines, and circulates in the blood wholly or mostly in the ionised form. Its further action, apart from a slight saline effect, is due to the iodide-ion. This has some peculiar influence on the metabolism of certain tissues, especially new-formed tissues. It is consequently largely used in the treatment of conditions characterised by the formation of new ill-developed tissue in various parts of the body, as in the tertiary stage of syphilis. It is also used in the treatment of rheumatic and gouty conditions, aneurisms, chronic skin diseases, asthma, bronchitis, and numerous other affections.

Many people are extremely susceptible to iodides in any form. In them a series of symptoms collectively known as **iodism** develop when iodides are taken even in small doses. The earliest symptoms usually simulate those of a ‘cold in the head.’ These may be followed by cutaneous eruptions, mental depression, and, after continued administration, by loss of flesh and other symptoms.

### **Potassii Iodidum**—KI.

Prepared in the same way as sodium iodide, replacing the solution of sodium hydroxide by a solution of potassium hydroxide. It may be crystallised at ordinary temperatures.

*Characters.*—Colourless, translucent or opaque, cubical crystals, with a saline, slightly bitter taste. Soluble in less than its weight of cold water, in 12 parts of alcohol (90 per cent.), in 40 parts of absolute alcohol, and in 3 parts of glycerin.

It may contain traces of bromides, chlorides, carbonates,<sup>1</sup> or sulphates.

<sup>1</sup> A small quantity of potassium carbonate is often added intentionally, and consequently potassium iodide frequently possesses a slight alkaline reaction.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Its action is almost identical with that of sodium iodide. The potassium-ion is more depressant to the heart and muscular tissue generally than the sodium-ion, but in ordinary therapeutic doses this action is rarely evident.

It is more largely used than sodium iodide because it crystallises better, and being non-deliquescent is more conveniently dispensed.

**Linimentum Potassii Iodidi cum Sapone.**—A liniment of almost ointment-like consistence containing potassium iodide, glycerin, and curd soap, and perfumed with oil of lemon.

Curd soap, 2 oz.; potassium iodide,  $1\frac{1}{2}$  oz.; glycerin, 1 fl. oz.; oil of lemon, 1 fl. dr.; distilled water, 10 fl. oz.

*Pharmacology.*—It has a very mild action, requiring many daily applications to produce a slight rubefacient effect. It is occasionally used in the treatment of chronic rheumatism. The consistence of the liniment is due to the partial ‘salting out’ of the soap.

**Unguentum Potassii Iodidi.**—Contains 10 per cent. by weight of potassium iodide.

Potassium iodide, 50; potassium carbonate, 3; distilled water, 47; benzoated lard, 400.

The potassium carbonate hinders the decomposition of the potassium iodide which is liable to occur when the lard becomes rancid.

*Pharmacology.*—A mild stimulating ointment of comparatively little value.

Potassium iodide is contained in the three preparations of iodine. It aids the solution of the latter.

**Plumbi Iodidum**— $PbI_2$ .

Obtained by the interaction of solutions of molecular quantities of lead nitrate or acetate and potassium iodide.

*Characters.*—A heavy golden-yellow crystalline powder. Soluble in somewhat less than 2,000 parts of cold or 200 parts of boiling water. Very slightly soluble in alcohol,

readily soluble in solutions of ammonium chloride, alkaline iodides, acetates, and a few other salts.

It should contain no nitrate or acetate.

It is almost solely used in the form of the ointment.

**Unguentum Plumbi Iodidi.**—Consists of lead iodide, 1; paraffin ointment (yellow), 9.

*Pharmacology.*—It resembles most closely a weak iodine preparation in action. When rubbed into the skin it produces mild irritation, but does not stain like iodine preparations. It is used almost solely in the treatment of enlarged glands.

**Arsenii Iodidum** (see page 201).

**Hydrargyri Iodidum Rubrum** (see page 188).

**Syrupus Ferri Iodidi** (see page 171).

**Sulphuris Iodidum.**—A weak compound of iodine and sulphur in molecular proportions.

Prepared by gently heating and afterwards fusing an intimate mixture of iodine 4, sublimed sulphur 1.

*Characters.*—Greyish-black masses, with a radiate crystalline, somewhat metallic, appearance. It is readily decomposed into its elements; the vessel containing it often shows crystals of sublimed iodine; it therefore has the odour of iodine. It should be kept in well-stoppered bottles.

It is insoluble in water, but slightly soluble in glycerin and in fats.

It is only used in the form of the ointment.

**Unguentum Sulphuris Iodidi.** — Contains 4 per cent. by weight of iodide of sulphur.

Sulphur iodide, 1; glycerin, 1; benzoated lard, 23.

*Pharmacology.*—Its action is similar to, but somewhat weaker than, that of iodine. It is irritant, and stains the skin in the same manner. It is used in the treatment of chronic skin diseases, especially those of a parasitic nature (ringworm, &c.).

## BROMIDES

Bromine itself is not official. It was formerly used as a caustic, but has deservedly fallen into disrepute.

The action of the official bromides is almost solely dependent on the bromide-ion. They consequently produce very similar effects.

**Sodii Bromidum**—NaBr.

Prepared in the same way as sodium iodide, replacing iodine by bromine. It should be crystallised above 50°C. to obtain the anhydrous salt. Below this temperature  $\text{NaBr} \cdot 2\text{H}_2\text{O}$  separates out.

*Characters.*—Small white cubic crystals, or crystalline powder, with a saline slightly bitter taste. It is somewhat deliquescent. Soluble in less than 2 parts of water, and in 15 parts of alcohol (90 per cent.).

It should contain only traces of chlorides, iodides, or sulphates and no other impurities. A special test is given in the Pharmacopœia to show the absence of thiocyanates. It is, however, not quite satisfactory.

*Dose.*—5 to 30 grains.

*Pharmacology.*—Its chief action is a depressant one upon the central nervous system. Locally, it exerts, in the main, a saline action. It is readily absorbed from the alimentary tract, and then depresses both the brain and spinal cord. After a full dose (20 to 30 grains), calmness, apathy, drowsiness and sleep follow in fifteen to forty minutes. The individual awakens after a variable time, feeling somewhat dull, but otherwise normal. The reflexes are distinctly diminished even by doses insufficient to produce sleep.

When repeatedly administered for some time a condition known as **bromism** results. This is characterised by cutaneous eruptions, especially so-called 'bromide acne,' by mental apathy often amounting to stupidity, by digestive disturbances, and other less important symptoms. These, as a rule, slowly disappear after the administration of the drug is stopped.

Sodium bromide is useful in the same conditions as potassium bromide (see below). It is less depressant to the



heart and other tissues than potassium bromide on account of the smaller toxicity of the sodium-, as compared with the potassium-ion, but the difference is not of therapeutic importance. It is somewhat deliquescent, and mainly on this account is less used than the potassium salt.

### **Potassii Bromidum**—KBr.

Prepared in the same manner as potassium iodide, replacing iodine by bromine.

*Characters.*—Colourless opaque cubical crystals, with a sharp saline taste. Soluble in less than twice its weight of water, and in about 120 parts of alcohol (90 per cent.).

It should contain no impurities except traces of chlorides, iodides, or sulphates. A special test is given to show the absence of thiocyanates (see sodium bromide).

*Dose.*—5 to 30 grains.

*Pharmacology.*—Practically the same as that of sodium bromide. The difference (of equi-molecular quantities) is the difference in action of the sodium- and potassium-ions, and this is of little practical importance. It is used much more than sodium bromide.

It is useful in the treatment of epilepsy; of certain disorders characterised or accompanied by convulsions or spasmodic conditions (*e.g.* infantile convulsions, whooping-cough, false croup, &c.), and, in general, of disorders where it is necessary to diminish the irritability of the brain or spinal cord.

### **Ammonii Bromidum**—NH<sub>4</sub>Br.

Prepared by neutralising hydrobromic acid with ammonia and crystallising. It cannot be made in the same way as the preceding bromides on account of its volatility.

*Characters.*—Small colourless crystals, or a white crystalline powder, inodorous, with a somewhat pungent saline taste. Soluble in less than twice its weight of water, and in about 14 parts of alcohol.

It may be sublimed unchanged. It should contain not more than traces of sulphates or chlorides, and no other impurity.

*Dose.*—5 to 30 grains.

*Pharmacology.*—Similar to that of sodium and potassium bromides. The ammonium-ion is somewhat stimulant to the nervous system, and hence ammonium bromide is regarded as being less depressant than the sodium and potassium salts. Practically the difference is small.

It is used in the same class of cases as sodium and potassium bromides, more especially in epilepsy and asylum practice. It is somewhat less pleasant to take.

It may be pointed out that equal weights of anhydrous sodium, potassium, and ammonium bromides contain different amounts of bromine as bromide. Roughly, ammonium bromide contains one-sixth more bromide than the same weight of potassium bromide.

**Acidum Hydrobromicum Dilutum.**—‘An aqueous solution containing 10 per cent. by weight of hydrogen bromide, HBr.’

Prepared by dissolving in water the gas obtained by distilling a mixture of potassium bromide and concentrated phosphoric acid.

*Characters.*—A colourless, mobile, inodorous acid liquid.

It should contain no impurities.

*Dose.*—15 to 60 minims.

*Pharmacology.*—Locally it possesses an acid action. After absorption it acts as a bromide. It is stated to be less depressant and to produce ‘bromism’ less readily than other bromides, but this is due simply to the smaller dose (of bromide-ion) which is given. (Roughly, 60 minims of dilute acid equal 8 grains of potassium bromide.)

It is useful in the same conditions as other bromides. Its acidity renders it somewhat more irritant locally and therefore not so well borne. It is said to diminish the tendency to ‘cinchonism’ (see page 291), but this is doubtful.

## CHLORINE

Chlorine is not official. It is, however, occasionally used as an aqueous solution in therapeutics, and is frequently employed as a disinfectant agent. For the latter purpose it is

commonly prepared by adding an acid to chlorinated lime. The action of chlorinated lime itself is due to the hypochlorite it contains, but this is similar to that of chlorine, so that this substance is conveniently described here.

**Calx Chlorinata**—bleaching powder. A mixture of calcium chloro-hypochlorite,  $\text{Ca}(\text{OCl})\text{Cl}$ , and slaked lime. It should yield 33 per cent. of chlorine on addition of excess of acid.

Prepared by exposing slaked lime to the action of chlorine gas until absorption ceases. About three-fifths of the lime is converted into calcium chloro-hypochlorite.

*Characters.*—A dirty white, dry powder with a chlorine-like smell. On exposure to air it becomes moist and gradually decomposes. It is only partially soluble in moderate amounts of water, the calcium chloro-hypochlorite alone dissolving, the hydrate remaining almost entirely undissolved.

Calcium chloro-hypochlorite is a very unstable compound. It is readily decomposed in the presence of moisture by the carbon dioxide of the air. Hypochlorous acid is given off, and to this the odour and activity of chlorinated lime are due.

It should be kept in hermetically-sealed packages or in well-stoppered bottles.

*Pharmacology.*—Moist chlorine and hypochlorites are powerfully disinfectant, and chlorinated lime is commonly used for this purpose. It is employed for disinfecting urine, fæces, &c., where a strong solution can be brought into immediate contact with the infected matter. It cannot be used for coloured fabrics on account of its bleaching properties, or for metal work. Simply exposed in a room chlorinated lime is deodorant, not disinfectant.

**Liquor Calcis Chlorinataæ.**—A solution of calcium chloro-hypochlorite, containing not less than 2 per cent. of available chlorine. When fresh it yields about 3 per cent. It should be kept in a cool dark place.

Prepared from 1 lb. of chlorinated lime and 1 gallon of distilled water.

*Pharmacology.*—It is powerfully disinfectant. When applied to the skin it produces a slight irritant effect manifest in a feeling of prickling and congestion, and, if continued, in cutaneous eruptions. It has been used in the treatment of infected wounds, of purulent discharges from mucous membranes, and as a disinfectant for the hands; also as a means of giving chlorine inhalations. Its irritant action limits its usefulness.

**Liquor Sodæ Chlorinataæ.**—A colourless alkaline liquid containing about  $2\frac{1}{2}$  per cent. available chlorine. It has an astringent taste and a faint chlorine-like odour.

Prepared by the interaction of solutions of sodium carbonate and chlorinated lime. It should be kept in a cool and dark place.

*Dose.*—10 to 20 minims.

*Pharmacology.*—Similar to that of the solution of chlorinated lime. It has been given internally in purulent diseases of the throat, and in certain infective conditions of the stomach and intestines, but as an intestinal disinfectant it is of doubtful value. As a wash or injection in the treatment of discharging mucous surfaces and offensive ulcers it is of greater service, but it is too irritating for general use.

A solution of chlorine for internal administration is often made by the interaction of hydrochloric acid and potassium chlorate (see page 117).

**Chlorides.**—These are of little therapeutical importance. The chloride-ion, owing to the number already existing in the blood, is pharmacologically inactive. The action of chlorides is therefore due to the metallic ion, or is a purely physical effect. The official chlorides will therefore be described under the individual metals.

## SULPHUR

Sulphur is official in two forms, sublimed and precipitated. These differ somewhat in colour and in the fineness of their particles, but are otherwise similar.



*Pharmacology.*—Being insoluble in ordinary media, sulphur exerts a purely protective action when applied to the skin. If rubbed into the skin, however, or allowed to lie in contact with it for some time, it interacts with the secretions and a small quantity of sulphide (and possibly sulphite) is formed. As soluble sulphides are irritant, sulphur locally applied may cause congestion and even inflammation.

Taken by the mouth, sulphur has no distinct action until it reaches the intestines. There, under the influence of the alkaline juices, alkaline sulphides are gradually formed, and these, acting as irritants to the intestinal mucous membrane, increase secretion and peristalsis and produce a laxative effect. Nearly all the sulphur of a pharmacopœial dose is discharged in the fæces unchanged. Most of that converted into sulphides is absorbed into the blood and is excreted as sulphides (perhaps mainly as hydrogen sulphide) by the lungs, skin, and other excretory organs, and as sulphates and intermediate products by the urine. The breath of a patient taking sulphur usually smells of sulphuretted hydrogen. During the process of excretion the sulphides stimulate slightly the bronchial and cutaneous secretions. The amount of sulphide formed from sulphur is, however, usually too small to produce any distinct general effect. Mental depression is sometimes experienced, and occasionally more definite symptoms.

Sulphur is largely used externally in the treatment of certain skin diseases, especially scabies ('itch') and acne. It is sometimes dusted on rheumatic joints, which are afterwards wrapped in flannel or cotton wool. Internally it is given as a laxative to children and to patients suffering from hæmorrhoids and other rectal diseases. It is also given in skin diseases, particularly acne, in chronic bronchitis, chronic rheumatism, lead poisoning, and other conditions. In some of these, however, sulphides (*e.g.* calx sulphurata) are more efficient.

Burning sulphur is employed to disinfect rooms (see page 73).

**Sulphur Sublimatum**—flowers of sulphur.

Prepared by subliming native sulphur or the crude sulphur obtained from various by-products, washing and drying.

*Characters.*—A bright greenish-yellow, slightly gritty powder, almost without taste or odour. Insoluble in water, but soluble in carbon bisulphide, chloroform, and oil of turpentine. It burns with a blue flame, forming sulphur dioxide, and can be entirely volatilised by heat.

It should contain no crystalline matter, no arsenium sulphide, and should have no action on litmus. (Unwashed sublimed sulphur is slightly acid owing to the presence of traces of sulphuric acid. This arises from hydration and oxidation of sulphur dioxide, which is formed in small quantity at the commencement of sublimation. Sulphur also becomes slightly acid on exposure to moist air.)

*Dose.* 20 to 60 grains.

*Pharmacology.*—Sublimed sulphur is used when the mechanical action of its particles is required in aiding its other effects (as in the treatment of scabies), and when the use of the smoother precipitated variety is not indicated.

**Confectio Sulphuris.**—Contains nearly half ( $\frac{1}{9}$ ths) its weight of sublimed sulphur.

Sublimed sulphur, 4 oz.; acid potassium tartrate, 1 oz.; tragacanth, 18 gr.; syrup, 2 fl. oz.; tincture of orange,  $\frac{1}{2}$  fl. oz.; glycerin,  $1\frac{1}{2}$  fl. oz.

*Dose.*—60 to 120 grains.

*Pharmacology.*—The cream of tartar and tincture of orange in this preparation are merely flavouring ingredients. The former gives it a slight acid taste. It is a pleasant preparation to administer to children.

**Unguentum Sulphuris.**—Consists of sublimed sulphur 1, benzoated lard 9.

*Pharmacology.*—When rubbed into the skin it produces the effects already described. It is used largely in the treatment of scabies, the coarse particles of sulphur helping to open up the burrows of the itch insect. For

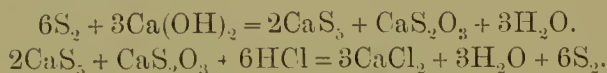
most other skin diseases this grittiness is objectionable ; and for many people the ointment is too strong.

**Pulvis Glycyrrhizæ Compositus.**— See page 403.

### **Sulphur Præcipitatum**—milk of sulphur.

Prepared by boiling for some time a mixture of sulphur and lime in water, decanting the yellow solution, adding hydrochloric acid until near neutralisation, washing and drying the precipitated sulphur.

Various polysulphides and thiosulphate of calcium are first formed. Taking the penta-sulphide as an example, the reactions may be indicated as follows :



*Characters.*—A greyish-yellow soft powder, free from grittiness. In most other characters it resembles sublimed sulphur.

It should not contain any crystalline matter, or smell of sulphuretted hydrogen.

*Dose.*—20 to 60 grains.

*Pharmacology.*—On account of its smoother nature it is better adapted for most therapeutic purposes than sublimed sulphur. The coarseness of the latter is no disadvantage in the treatment of scabies or when employed as a laxative, but it is for use as a dusting powder, lotion, or ointment in most cases.

**Trochiscus Sulphuris.**—Each lozenge contains 5 grains of precipitated sulphur.

Precipitated sulphur, 5 ; acid potassium tartrate, 1 ; sugar, 8 ; tincture of orange, 1 ; gum acacia, 1 ; mucilage of gum acacia, 1.

Compare with the composition of *Confectio Sulphuris*.

*Pharmacology.*—As in the confection the acid tartrate of potassium and tincture of orange are merely flavouring ingredients. Precipitated sulphur, being smoother, is more pleasant to take in the form of a lozenge than is sublimed sulphur.

The lozenge is a convenient means of administering sulphur.

**Potassa Sulphurata**—liver of sulphur. A mixture of potassium mono- and polysulphides and thiosulphate. It usually contains potassium sulphate and carbonate.

Prepared by fusing together potassium carbonate 2 parts, and sublimed sulphur 1 part. It rapidly deteriorates when exposed to moist air.

*Characters.*—Dull greenish irregular pieces, with a faint odour of sulphuretted hydrogen and an alkaline acrid taste. The freshly fractured surface is liver-brown in colour. Soluble in about 2 parts of water; about 50 per cent. is soluble in 90 per cent. alcohol.

*Pharmacology.*—Applied to the skin, it softens the epidermis and acts as an irritant, producing inflammation if applied for long. When taken by the mouth large doses cause severe irritation of the gastro-intestinal tract, and after absorption affect the nervous system, depressing the medullary centres and producing coma and often convulsions.

Sulphurated potash is only used externally. As an ointment (10 to 20 grains to 1 ounce) it is useful in scabies and some chronic eczematous and acneiform eruptions. It may also be applied as a lotion (1 in 30 or 40) and, if large areas are affected, as a bath (60 grains to 1 gallon). Besides skin diseases, the baths are useful in chronic rheumatism and allied conditions.

**Calx Sulphurata.**—Contains about 50 per cent. of calcium sulphide,  $\text{CaS}$ , with calcium sulphate and carbon.

Prepared by heating native calcium sulphate and wood charcoal in a crucible until sufficient sulphate is reduced.

*Characters.*—A greyish-white powder with a faint odour of sulphuretted hydrogen. Slightly soluble in water; insoluble in alcohol. It gradually decomposes when exposed to moist air.

*Dose.*— $\frac{1}{4}$  to 1 grain.

*Pharmacology.*—It has a similar action to sulphurated potash but is less powerfully irritant. When taken in pharmacopœial doses it produces no distinct symptoms beyond unpleasant eructations of sulphuretted hydrogen, but if given repeatedly it appears to exert a beneficial influence on commencing suppuration if this is present.



It has been used externally as a depilatory, but it is chiefly administered internally in the treatment of boils, acne, and similar conditions.

### CARBON

Wood charcoal is alone official.

**Carbo Ligni**—the residue left after wood has been exposed to a red heat without the access of air.

*Characters.*—A black insoluble powder, tasteless and odourless, and free from gritty matter. It should not leave more than  $7\frac{1}{2}$  per cent. of ash.

*Dose.*—60 to 120 grains.

*Pharmacology.*—Its action is a purely physical one, and is dependent upon its mechanical action and its power of condensing gases within its pores. The latter is its most important action.

Charcoal is able to take up many times its volume of gases, and in many cases, by means of the oxygen it has absorbed, to destroy them. Thus considerable quantities of sulphuretted hydrogen are absorbed and oxidised. Charcoal is therefore a deodorant. It is in no sense an antiseptic or disinfectant. When wetted, it largely loses this power of absorbing gases, but not altogether. In this condition it is still able to take up solids, *e.g.* colouring matters, from solutions, and is used for this purpose. It will also take up small quantities of alkaloids, and has been employed in poisoning by these substances.

When taken by the mouth, charcoal is not absorbed. It takes up gases when present, and to a slight extent other substances, in the stomach and intestines, and it is consequently of use in flatulence. It also diminishes the odour of the fæces. After large doses its mechanical action becomes evident in the laxative effort which it often produces.

Charcoal is mainly used for destroying the unpleasant effluvia arising from drains. It was employed, sprinkled on a poultice, for cleansing foul-smelling wounds, but it is rarely

used for this purpose now. For flatulence it must be given in full doses.

## CARBON BISULPHIDE

### **Carbonis Bisulphidum—CS<sub>2</sub>.**

Prepared by passing sulphur vapour over red-hot charcoal, and condensing and purifying the product.

*Characters.*—A colourless, highly refractive, very volatile and inflammable liquid, having a characteristic ethereal but not fetid odour. Soluble in about 500 parts of water, readily in alcohol, ether, chloroform, and in fixed and volatile oils.

It should not contain sulphur or sulphuretted hydrogen, or give an acid reaction.

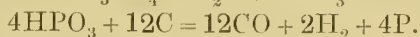
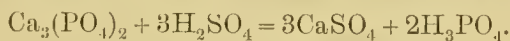
The unpleasant odour of commercial carbon bisulphide is mainly due to the presence of other organic sulphur compounds formed during manufacture and by exposure to light.

*Pharmacology.*—It is used only as a solvent, for phosphorus, caoutchouc, &c. It produces, however, both acute and chronic forms of poisoning. The latter is of most importance, a characteristic feature of it being the symptoms of a peripheral neuritis.

## PHOSPHORUS

**Phosphorus.**—‘A solid non-metallic element obtained from calcium phosphate.’

Prepared by treating calcium phosphate (bone ash) with sulphuric acid, filtering off the solution of phosphoric acid formed, evaporating it to dryness, and heating with charcoal. The phosphoric acid is first converted into metaphosphoric acid, and this, when the temperature is raised to a white heat, is decomposed by the charcoal, phosphorus distilling over.



*Characters.*—An almost colourless or yellowish translucent solid, readily cut with a knife, volatile and very inflammable, and having a characteristic garlic-like odour. It

is usually seen in the form of thickish sticks covered with a yellowish or reddish film. In moist air it emits white vapours of phosphorous anhydride, and in the dark is luminous owing to the rapid oxidation involved in this process. It is insoluble in water, but soluble in 320 parts of absolute alcohol, in 80 parts of pure ether, in 25 parts of chloroform, and in about 80 parts of olive oil or of oil of turpentine. One part of carbon disulphide dissolves about 9 parts. It is kept under water.

Specific gravity, 1.77. It should contain no arsenium compounds, and only traces of sulphates.

*Dose.*— $\frac{1}{100}$  to  $\frac{1}{20}$  grain.

*Pharmacology.*—Phosphorus is of greater interest from a toxicological than a therapeutical point of view. It has been largely used in treatment in the past, but at present it is comparatively rarely employed.

When merely handled, phosphorus exerts very little effect upon the skin, but if rubbed into the skin troublesome sores are produced. Taken by the mouth in small doses ( $\frac{1}{100}$ — $\frac{1}{50}$  grain), it has an unpleasant taste, but in most persons no other effect. Somewhat larger doses ( $\frac{1}{20}$  grain) usually induce nausea and may cause vomiting. Much larger doses ( $\frac{1}{2}$ —1 grain), if in a finely divided state, are poisonous. Usually no symptoms appear for some hours; then there is epigastric discomfort followed by pain, nausea, and vomiting. These symptoms may increase and death may occur from collapse, but more usually considerable recovery follows and the patient may even appear moderately well. In two to three days, however, the symptoms reappear accompanied by jaundice; the liver is tender and enlarged; weakness and depression, followed by somnolence, set in, and the patient dies in a comatose condition. Other symptoms, *e.g.* bleeding from mucous membranes, may be dominant, but these cases are comparatively rare. On microscopic examination the cells of the tissues are found to have undergone fatty degeneration.

Besides acute phosphorus poisoning, a chronic form, seen especially in match workers, occurs. This, in most cases, is characterised by necrosis of the jaw ('phossy jaw').

Very small doses of phosphorus given for long periods induce, in young animals, a curious change in the bones (Wegner). Instead of cancellous tissue, compact tissue is laid down in the ends of long bones, the ribs, vertebræ, &c., and there is an increased deposition under the periosteum. In fowls the long bones may become solid rods. This action appears to be a true stimulation of ordinary bone formation and not a simple increase in the deposition of lime salts. As a result of these researches phosphorus was recommended for certain diseased conditions associated with changes in the bones (rickets, osteomalacia, ununited fracture), but it does not seem to have proved of much value. Nor does it appear to have been of certain benefit in the numerous other conditions (nervous exhaustion, hysteria, certain blood diseases and cutaneous diseases, &c.) in which it has been tried. It is, however, said to be beneficial in some forms of neuralgia (intercostal, &c.). It is given best in the form of a pill.

**Oleum Phosphoratum.**—A 1 per cent. solution by weight of phosphorus in almond oil.

The almond oil is first heated to about 150°C. for 15 minutes, and afterwards cooled and filtered. This removes air and moisture and other impurities which may lead to oxidation of the phosphorus. Notwithstanding this treatment, the preparation does not keep well under ordinary conditions. It deposits a reddish precipitate.

*Characters.*—Similar to those of almond oil, but having the characteristic odour of phosphorus and being phosphorescent in the dark.

*Dose.*—1 to 5 minims.

**Pilula Phosphori.**—Contains 2 per cent. of phosphorus.

Phosphorus, 1; white beeswax,  $12\frac{1}{2}$ ; lard,  $12\frac{1}{2}$ ; kaolin,  $11\frac{1}{2}$ . (Carbon disulphide is used to dissolve the phosphorus.) Keep the mass under water in the dark until required, then to each 3 gr. add 1 gr. of powdered gum acacia. The pills should be varnished.

*Dose.*—1 to 2 grains.

*Pharmacology.*—It is not a good pill, since it does not disintegrate readily.



## METALS AND THEIR COMPOUNDS

THREE metals—sodium, iron, and mercury—are official. Sodium is used for making *Liquor Sodii Ethylatis*; iron for making three syrups, a wine, and two liquors; mercury for making the liquor and ointment of nitrate of mercury, and certain preparations in which the metal is present in a finely divided ('extinguished') form. In the latter state mercury is employed in therapeutics. Iron, in the form of reduced iron (*Ferrum Redactum*), is also used therapeutically.

Most of the common compounds of the metals are official. A few are solely employed in making other preparations, but the majority are for administration in disease.

## THE ALKALI METALS

Compounds of sodium, potassium, lithium, and ammonium (which is usually associated with the alkali metals) are official.

With the exception of the compounds of ammonium (which differs pharmacologically from the rest much more than it does chemically), the compounds of the alkali metals closely simulate one another in pharmacological action. This is due to the fact that their action is mainly dependent on the anion, not on the kation (metallic ion). Differences in the kations are easily demonstrated pharmacologically, but they are not present to any appreciable extent in doses which are administered therapeutically.

Since sodium chloride exists in large quantities in the blood and tissue-juices, it, as well as the sodium- and chloride-ions into which it is largely dissociated, may be said to be without chemical action as such. Sodium chloride, in other words, when administered, produces its effects by a physical action or, as happens to a slight extent, indirectly. The difference in action of other sodium compounds, apart from what can be explained

by physical differences, must be due to the anion; and similarly the difference in action of the chlorides of the metals must be due to the kation. Potassium chloride, for example, is what is called a muscle-poison, an effect which must be due to the potassium-ion. This action is, in fact, common to all potassium salts. The lithium-ion has a similar action.

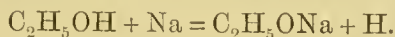
## SODIUM COMPOUNDS

**Sodium.**—A metallic element, of a tough waxy consistence, imparting an intense yellow coloration to the flame. It violently attacks water or alcohol. When freshly cut it shows a bright metallic surface, which quickly tarnishes owing to oxidation. It is kept under naphtha.

It is only used to make—

**Liquor Sodii Ethylatis.**—An alcoholic liquid containing 18 per cent. of sodium ethylate,  $C_2H_5ONa$ .

Prepared by cautiously dissolving 1 gramme of clean sodium in 20 c.c. of absolute alcohol in a flask kept cool by a stream of cold water.



*Characters.*—A colourless corrosive liquid of syrupy consistence. It becomes brown by keeping.

*Pharmacology.*—It is a caustic, but is rarely used.

**Sodii Carbonas**— $Na_2CO_3, 10H_2O$ .

Prepared from sodium chloride by (a) the Solvay or ammonia-soda process; (b) the Leblanc process. The former consists in decomposing sodium chloride with ammonium bicarbonate, and calcining the sodium bicarbonate which separates out; the latter, in first making sodium sulphate, which is subsequently heated with calcium carbonate and carbon, and purifying the product (black ash) by lixiviation, calcination, and crystallisation.

*Characters.*—Large transparent colourless crystals, with an unpleasant, strongly alkaline taste; efflorescent in air, finally falling to powder. Soluble in less than twice its weight of water, almost insoluble in alcohol.

It should contain no impurity except traces of chlorides, sulphates, or ammonium. A special test is given in the Pharmacopœia to prove the absence of thiocyanate which is liable to be formed in the Leblanc process.

For neutralisation equivalents see footnote, page 99.

*Dose.*—5 to 30 grains.

*Pharmacology.*—Its pharmacological action is dependent on (a) its alkalinity; (b) the liberation of carbon dioxide by acids; (c) to a less extent to the physical action known as a saline action.

Just as we have an acid pharmacological action due to the hydrogen-ion, so we have an alkaline pharmacological action, common to all substances possessing alkaline characters, which is due to the hydroxyl-ion. When sodium carbonate is dissolved in water it may be said to dissociate into Na-ion and  $\text{CO}_3$ -ion, but the latter, like the anion of all very feeble acids, re-acts with the water, combining with some of its H to form un-ionised carbonic acid, thus leaving a corresponding number of OH-ions free. These cause the alkalinity of sodium carbonate solutions.

The fundamental pharmacological action of the hydroxyl-ion ('alkaline' action) is due to its power of (i.) neutralising acids; (ii.) saponifying fats; (iii.) combining with albumen to form alkali-albumen. The first and last actions will be referred to later (pages 111, 112). To the second is mainly due the cleansing action of alkalies upon the skin.

Saturated sodium carbonate solutions are fairly powerfully alkaline, and besides cleansing the skin cause marked irritation if long applied. It is not much used therapeutically, sodium bicarbonate and the potassium compounds being preferred. (See these.)

**Sodii Carbonas Exsiccatus**— $\text{Na}_2\text{CO}_3$ . Nearly anhydrous sodium carbonate.

Prepared by heating sodium carbonate or bicarbonate.

*Characters.*—A dry white powder, with a harsh alkaline taste. It is somewhat hygroscopic. Soluble in 6 parts of water, insoluble in alcohol.

It should not contain more than traces of water.

*Dose.*—3 to 10 grains.

It is used in making **Pilula Ferri**. The ordinary carbonate could not be employed, as the chemical interaction which occurs in this pill (see page 169) would set free the water of crystallisation, and this would soften the mass and make it unworkable.

*Pharmacology.*—The same as that of sodium carbonate, except that, being anhydrous, it has a greater affinity for water, and is consequently somewhat more irritant when applied to mucous membranes. It is only official for use in pills.

**Sodii Bicarbonas**— $\text{NaHCO}_3$ .

Prepared by the Solvay or ammonia-soda process (see page 97); or by exposing partially dried crystals of sodium carbonate to the action of carbon dioxide.

*Characters.*—Small colourless opaque crystals, or white micro-crystalline powder, with a saline, somewhat alkaline and bitter taste. Soluble in 12 parts of water, insoluble in alcohol.

It should contain only traces of chlorides, sulphates, or ammonium, and no thiocyanate or other impurity.

For neutralisation equivalents see footnote.<sup>1</sup>

It is a constituent of all **effervescing** preparations.

*Dose.*—5 to 30 grains.

**Trochiscus Sodii Bicarbonatis.**—Each lozenge contains 3 grains of sodium bicarbonate. Rose basis.

*Pharmacology.*—Like sodium carbonate, its pharmacological action depends upon (a) its alkalinity; (b) the liberation of carbon dioxide by acids; (c) the physical action known as a saline action.

Saturated solutions are comparatively mildly alkaline. This is partly owing to the small solubility of the salt, but mainly to the fact that being an acid salt it yields on solution only a comparatively small number of hydroxyl-ions.

Applied externally in solution it is slightly cleansing and sedative. When taken by the mouth it has a somewhat bitter

<sup>1</sup> To avoid repetition, the neutralisation equivalents of the more important substances are given in one formula. This is more easily remembered than several independent formulæ. It is not exact, but is sufficiently so for practical purposes.

20 grains of sodium bicarbonate = 34 grains of sodium carbonate = 24 grains of potassium bicarbonate = 20 grains of potassium carbonate = 13 grains of ammonium carbonate = 18 grains of tartaric acid = 17 grains of citric acid.



saline taste, and exerts a mild sedative action. In the stomach it interacts with the acid of the gastric contents when this is present, and forms sodium chloride, lactate, or other salt, and carbonic acid. The latter has a sedative action on the gastric walls. If administered before a meal, when there is little or no acid to neutralise, sodium bicarbonate is sedative. The main effect of this salt ends here. Its further action is complicated by physiological conditions which are variable. It may lead to an increase in the alkalinity of the intestinal contents, and directly or indirectly to a slight increase in the alkalinity of the blood and urine, but it is not employed for this purpose.

It is used externally as a sedative lotion in skin diseases, and, internally, is given in acute and some forms of chronic gastric catarrh, in gastric hyperacidity (heartburn), gastric ulcer, and other gastric affections.

**Sodii Chloridum**—NaCl. Purified common salt.

*Characters.*—Small, transparent, colourless, cubic crystals, or dry, white, micro-crystalline powder, with a strong pure saline taste. Soluble in less than 3 parts of water, almost insoluble in alcohol.

It should contain not more than traces of calcium, magnesium, or sulphates, and no other impurity.

*Pharmacology.*—The action of common salt is important both from a theoretical and a practical point of view. It exhibits in the purest form what has been termed a salt or saline action. This is fundamentally a purely physical action, mainly dependent upon the process of osmosis. If a red blood corpuscle is placed in a solution of common salt of a certain strength it will undergo no apparent change. If placed in a much weaker or stronger salt solution it will swell in the former or contract in the latter case. Other changes may occur, but these need not be considered. The first-named solution will be found to exert approximately the same osmotic pressure as the serum of the blood, and it is said to be isotonic with the blood. The weaker and stronger solutions are said to be hypotonic (hypisotonic) and hypertonic (hyper-

isotonic) respectively. From a pharmacological point of view water is a hypotonic solution.

For frog's blood 0.6 per cent. NaCl, for mammalian blood about 0.9 per cent. NaCl is an isotonic solution.

To obtain the above effects of hypotonic and hypertonic solutions the substance in solution must not penetrate, or only to a slight extent, into a cell. If it penetrates easily, as do many ammonium salts, swelling of the cell occurs with all strengths of solution. This, however, is uncommon. Most inorganic and many organic substances are taken up by the cell with difficulty.

That alterations in the vital activity of the cell must accompany such obvious changes will be readily understood. With slight changes increase in activity occurs; with marked changes death results.

These changes occur to a greater or less extent when salt solutions are applied or administered to the body, and the cells of the body react in varying degree according to their situation and function. When strong brine solutions are applied to the skin, irritation and even inflammation result if the application is at all prolonged. This is due to the salt abstracting fluid from the superficial cells, and the consequent reaction beneath. The smarting induced by sprinkling salt on a wound, and the irritation of the stomach resulting in vomiting which occurs after large doses of salt have been swallowed, are largely due to the same cause.

After absorption into the blood, unless taken in very dilute solution, moderate doses increase the osmotic pressure of the blood as compared with the tissues, and interchange of diffusible substances occurs. The kidneys are also stimulated and diuresis results; and interchange and excretion go on until a normal balance is again established. This action is further complicated by conditions which need not be entered into here, but attention may be drawn to the fact that this action is not limited to salts, but occurs with every substance which exerts a certain osmotic pressure in aqueous solution, and to which the cell membrane is impermeable or only slightly permeable.

One important result may be deduced from this. When applying solutions to sensitive mucous membranes (eye, nose) or to large wounds or serous surfaces, it is necessary, in order to avoid producing pain and damaging the tissues, to make the solution of approximately the same osmotic pressure as the fluids which normally bathe these tissues.

Common salt may be used to induce vomiting in cases of emergency. A solution is sometimes injected into the rectum in the treatment of thread worms.

**Sodii Bromidum.**—See page 83.

**Sodii Iodidum.**—See page 79.

**Sodii Sulphas**—Glauber's salt.  $\text{Na}_2\text{SO}_4, 10\text{H}_2\text{O}$ .

Prepared by the action of sulphuric acid on sodium chloride or sodium nitrate; and in other ways.

*Characters.*—Colourless, transparent crystals, efflorescent, with a bitter saline taste. Soluble in  $3\frac{1}{2}$  parts of water ( $12.5^\circ\text{C}$ .), insoluble in alcohol.

A solution saturated at  $30^\circ\text{C}$ . deposits crystals on heating to the boiling-point. These are crystals of anhydrous sodium sulphate. The phenomenon is due to the fact that at  $33^\circ\text{C}$ . the deca-hydrate in solution is converted into the anhydrous salt, the solubility of which diminishes with increase of temperature.

It should contain only traces of chlorides and no other impurity.

*Dose.*—30 to 120 grains for repeated administration;  $\frac{1}{4}$  to  $\frac{1}{2}$  an ounce for a single administration.

*Pharmacology.*—It is a saline purgative. This action is due to the difficulty with which it is absorbed from the intestinal canal. When administered in full doses it usually produces no obvious effect beyond its bitter saline taste, and occasionally slight nausea, until it reaches the intestinal tract. Here it is not absorbed to any appreciable extent, and, owing mainly to physical processes, it prevents the absorption of water and other substances in solution, and may even cause excretion of water from the blood. At the same time it gently stimulates the intestinal mucous membrane, increased peristalsis results, and the intestinal contents are hastened

on. If taken on an empty stomach a liquid stool is passed in about two hours.

Smaller doses when given repeatedly also produce a purgative effect; but if the dose is insufficient to cause this, the salt is absorbed and an increase in the urine excreted results.

Sodium sulphate is useful in simple cases of constipation, and in other conditions, such as diseases of the liver, where a purgative action is required. It is also of use in the colic and constipation of plumbism. It is the principal ingredient of the mineral waters of many Spas, Marienbad, Franzenbad, and Carlsbad being the chief.

**Sodii Sulphas Effervescens.**—A white granulated mixture, effervescing when added to water, and containing the equivalent of half its weight of  $\text{Na}_2\text{SO}_4, 10\text{H}_2\text{O}$ .

Sodium sulphate, 50; sodium bicarbonate, 50; tartaric acid, 27; citric acid, 18.

The sodium sulphate is heated until dry, powdered, and mixed with the other ingredients, previously powdered. The mixture is then heated in a dish to about  $100^\circ\text{C}$ . (it is advisable to heat the dish previously to this temperature), is constantly stirred, and, as soon as it tends to fuse, is transferred for granulation to sieves of a proper size. It is afterwards dried at a temperature under  $55^\circ\text{C}$ .

*Dose.*—60 to 120 grains for repeated administration;  $\frac{1}{4}$  to  $\frac{1}{2}$  an ounce for a single administration.

*Pharmacology.*—Its action is similar to that of sodium sulphate. It is somewhat pleasanter to take and is often better borne by the stomach. The sodium citrate and tartrate, which are formed by the interaction of the citric and tartaric acids with the sodium bicarbonate, aid the action of the sodium sulphate, and therefore the dose of this preparation is the same as that of sodium sulphate. It is used for the same purposes.

**Sodii Phosphas** — di-sodium hydrogen phosphate.  
 $\text{Na}_2\text{HPO}_4, 12\text{H}_2\text{O}$ .

Prepared by adding sodium carbonate to phosphoric acid until the mixture is alkaline, filtering, and evaporating.



*Characters.*—Large colourless transparent crystals, efflorescent, with a cool saline taste. Soluble in 7 parts of water, forming an alkaline solution ; insoluble in alcohol.

It should contain no impurities except traces of sulphates or chlorides. When heated to dull redness it is converted into sodium pyrophosphate.

The effloresced salt has the composition  $\text{Na}_2\text{HPO}_4, 7\text{H}_2\text{O}$ .

*Dose.*—30 to 120 grains, for repeated administration ;  $\frac{1}{4}$  to  $\frac{1}{2}$  an ounce for a single administration.

*Pharmacology.*—Its action is similar to that of sodium sulphate. It is pleasanter to take and is milder in its action, and it has also a slight alkaline action.

It is used as a saline purgative in simple cases of constipation.

**Sodii Phosphas Effervescens.**—A white granulated mixture containing the equivalent of half its weight of  $\text{Na}_2\text{HPO}_4, 12\text{H}_2\text{O}$ .

Preparation and proportions the same as Sodii Sulphas Effervescens, replacing sodium sulphate by sodium phosphate.

*Dose.*—60 to 120 grains for repeated administration ;  $\frac{1}{4}$  to  $\frac{1}{2}$  an ounce for a single administration.

*Pharmacology.*—Its action and uses are the same as the preceding compounds. It is the best saline purgative to administer to children.

**Soda Tartarata**—sodium potassium tartrate. Rochelle salt.  $(\text{CHOH})_2\text{COONa} \cdot \text{COOK}, 4\text{H}_2\text{O}$ .

Prepared by neutralising acid potassium tartrate with sodium carbonate in presence of water, concentrating, filtering, and crystallising.

*Characters.*—Large colourless transparent crystals with a cool saline taste. Soluble in less than twice its weight of water ; insoluble in alcohol.

*Dose.*—120 to 240 grains.

*Pharmacology.*—It is a saline purgative. Its mode of action and uses are the same as those of other members of this class. It is pleasanter to take than sodium sulphate, but is rarely given except in the form of the official effervescing powder.

**Pulvis Sodæ Tartaratæ Effervescens** — Seidlitz powder. Consists of an alkaline powder (wrapped in blue paper) containing sodium potassium tartrate, 120 grains, and sodium bicarbonate, 40 grains; and an acid powder (wrapped in white paper) containing tartaric acid, 38 grains.

*Dose, for a draught.*—‘The alkaline powder dissolved in nearly half a pint of cold or warm water, and the acid powder then added.’

**Sodii Citro-tartras Effervescens.**—A white granulated mixture effervescing on the addition of water.

Sodium bicarbonate, 51; tartaric acid, 27; citric acid, 18; refined sugar, 15. Mix the powders thoroughly and prepare as described under Sodii Sulphas Effervescens. It will be noticed that this preparation contains sugar. The proportion of the other ingredients is practically the same as in the preceding effervescent preparations. After effervescence has subsided the draught is slightly acid.

*Dose.*—60 to 120 grains.

*Pharmacology.*—In small doses it is sedative to the stomach on account of the carbonic acid formed during effervescence. In large doses (full pharmacopœial doses or more) it is a saline purgative. It is pleasant to take, on account of the slight acidity and sweetness of the solution. In non-purgative doses the sodium citrate and tartrate are absorbed and undergo the same changes as the corresponding potassium compounds (pages 114, 115).

It is a common remedy in nausea and sickness. Taken on an empty stomach, it is also used as a mild saline purgative, especially for children.

**Borax**—sodium biborate. Sodium pyroborate.  $\text{Na}_2\text{B}_4\text{O}_7, 10\text{H}_2\text{O}$ .

It occurs native (as tincal), and is prepared artificially by neutralising a boiling solution of native boric acid with sodium carbonate, or by boiling native calcium or magnesium borates with solution of sodium carbonate.

*Characters.*—Large transparent colourless crystals, somewhat efflorescent, with a slightly cool saline bitter taste and

sweet after-taste. Soluble in 25 parts of water, in  $\frac{1}{2}$  part of boiling water, and in 1 part of glycerin; insoluble in alcohol. An aqueous solution has a weak alkaline reaction.

A solution turns turmeric paper a brown colour. If a mineral acid is added to a hot saturated solution, crystals of boric acid are precipitated.

It should contain not more than traces of chlorides or sulphates, and no other impurity.

*Dose.*—5 to 20 grains.

*Pharmacology.*—It has (i.) a saline action; (ii.) a mild alkaline action; (iii.) a slight antiseptic action. Weak solutions applied externally are mildly sedative. When taken by the mouth in full pharmacopœial doses it usually produces no obvious symptoms; occasionally it causes mild gastric and renal irritation. If taken for long periods it may cause gastro-intestinal, renal, and nervous symptoms and cutaneous eruptions. It is readily absorbed, and is excreted unchanged, mainly in the urine.

It is used externally as a mild sedative and antiseptic lotion to inflamed mucous membranes and in skin diseases, and as a wash for the scalp in falling off of hair. It appears, however, to make the hair somewhat brittle. It has been given internally in epilepsy, but with doubtful benefit.

**Glycerinum Boracis.**—A solution of 1 of borax in 6 of glycerin.

A chemical change occurs, but is of no practical importance (see page 26).

*Pharmacology.*—The glycerin diminishes the intensity and prolongs the action of the borax. This preparation is mildly stimulant, sedative, and antiseptic. It is used for painting on chronically inflamed mucous membranes, such as the throat, and may be used to make strong borax lotions. It may also be employed instead of Mel Boracis for aphthous stomatitis.

**Mel Boracis.**—Contains 1 of borax in  $9\frac{1}{2}$  of product, by weight.

Borax, 1; glycerin,  $\frac{1}{2}$ ; clarified honey, 8.

*Pharmacology.* — Only used in the treatment of aphthous stomatitis in children. Part of its action in this condition is due to its alkalinity.

**Sodii Sulphis**— $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$ .

Prepared by passing sulphur dioxide into a solution of sodium carbonate.

*Characters.*—Colourless transparent inodorous crystals, efflorescent in dry air, with a saline and sulphurous taste. Soluble in 2 parts of water, and in 25 parts of glycerin; insoluble in alcohol. Its aqueous solution is usually faintly alkaline.

It generally contains sulphate, but should contain no thiosulphate.

The effloresced salt, it is usually stated, consists of sodium sulphate, but recently it has been said to consist of anhydrous sodium sulphite.

*Dose.*—5 to 20 grains.

*Pharmacology.*—It has a slightly antiseptic and a saline action. When a solution is acidified, however, it becomes much more powerfully antiseptic owing to the sulphurous acid which is formed. Externally and in the mouth, therefore, it is comparatively mildly antiseptic, but in the stomach, when acid is present, it is powerfully antiseptic owing to the sulphurous acid liberated. The formation of this acid is sometimes unpleasantly evident in the sulphurous eructations which occur after this drug has been taken. The sulphurous acid is oxidised to sulphuric acid in the stomach, and the drug consequently exerts no further antiseptic action.

It is sometimes used externally as an antiseptic lotion in certain skin diseases (chloasma, &c.), but a lotion of sulphurous acid is better. Such lotions, however, will often relieve itching. Internally, it is given for abnormal fermentation in the stomach.

**Sodii Sulpho-carbolas** — sodium phenol - para - sulphonate.  $\text{C}_6\text{H}_4\text{OH} \cdot \text{SO}_2\text{ONa} \cdot 2\text{H}_2\text{O}$ .

Prepared by dissolving phenol in excess of sulphuric acid, maintaining the mixture at a temperature of about  $100^\circ\text{C}$ . for some time, and afterwards converting the phenol-sulphonic acid, through the barium salt, into the sodium salt.



The mixture of phenol and sulphuric acid is heated to convert ortho-phenol sulphonic acid, which is also formed in the early stages into the para- variety.

*Characters.*—Colourless, transparent, inodorous crystals, with a saline and bitter taste. Soluble in 6 parts of water, in 6 parts of glycerin, and in 150 parts of alcohol. Solutions should be neutral.

A weak solution gives a violet coloration with ferric chloride solution. On igniting the salt, phenol is driven off, and a residue of sodium sulphate remains. It should contain no sulphates.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It is a mild antiseptic, and is used for abnormal fermentation occurring in the stomach. It is not as efficacious as sodium sulphite.

It is comparatively non-poisonous. The toxic action of phenol is markedly diminished by the introduction of certain radicals, and of these the sulphon- group is one.

### **Sodii Hypophosphis**— $\text{NaPH}_2\text{O}_2$ .

Prepared by the interaction of solutions of sodium carbonate and calcium hypophosphite.

*Characters.*—A white granular deliquescent salt, with a slightly sweetish, saline taste. Soluble in less than its own weight of water, in 30 parts of alcohol, and in 2 parts of glycerin; insoluble in ether.

It is readily oxidised. When heated in air it undergoes decomposition and evolves a spontaneously inflammable gas consisting of hydrogen phosphide and hydrogen.

It should contain no impurities except traces of carbonates, phosphates or phosphites. The official quantitative test requires the salt to contain 96 per cent. of anhydrous sodium hypophosphite, but this standard is rarely reached commercially.

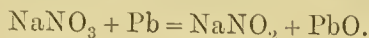
*Dose.*—3 to 10 grains.

*Pharmacology.*—The hypophosphites are largely used in debility from various causes, especially of phthisis. They are believed to improve nutrition, but a difference of opinion exists regarding their value. According to the most recent

experiments, they increase slightly the quantity of urine, and the urea, phosphates, and chlorides in it, but in what way this modification of metabolism is produced is not stated. Hypophosphites themselves are excreted unchanged in the urine.

**Sodii Nitris**— $\text{NaNO}_2$ .

Prepared by fusing sodium nitrate with metallic lead, which is added in small portions.



*Characters*.—Small white deliquescent crystals, with a saline taste. Soluble in less than twice its weight of water, slightly soluble in alcohol. Its solutions are neutral or slightly alkaline.

It should contain not less than 95 per cent. of anhydrous sodium nitrite, and not more than traces of lead.

*Dose*.—1 to 2 grains.

*Pharmacology*.—It is a vaso-dilator. It acts on the peripheral blood-vessels because a solution perfused through the blood-vessels of an organ removed from the body causes marked dilatation of them. After a full dose (2 grains) has been given by the mouth to a healthy man, the blood-vessels begin to dilate in 4 to 5 minutes, and continue to dilate for 10 to 20 minutes; then they gradually contract and reach their previous state in  $1\frac{1}{2}$  to 2 hours.

When added to blood, sodium nitrite produces met-hæmoglobin. This occurs in the body after doses of 20 grains or more have been given, and manifests itself in duskiness of the skin and the mucous membranes. It kills by producing this change in the blood; it is what is termed a blood-poison.

It is used to dilate the blood-vessels in diseased conditions associated with 'high arterial tension,' but other vaso-dilators are more usually preferred (see page 226 *et seq.*).

**Sodii Arsenas**.—See page 199.

**Sodii Benzoas**.—See page 244.

**Sodii Salicylas**.—See page 246.

**Liquor Sodæ Chlorinatæ.**—See page 87.

**Sapo Durus** and **Sapo Animalis** are mainly sodium oleate and sodium stearate respectively. They owe their pharmacological action principally to their alkalinity—*i.e.* to the hydroxyl-ions they form in solution, but they are more conveniently described later (see page 553).

## POTASSIUM

The number of potassium salts official is about equal to that of the sodium salts. This is due to the fact that some of the official potassium salts are found 'native,' and some crystallise better than the corresponding sodium compounds.

The action of potassium salts differs very little from that of the corresponding sodium salts. What difference exists is due to the action of the potassium-ion and to the difference in solubility of the potassium and sodium compounds.

The latter, for example, was believed to play an important part in the treatment of gout. This disease is associated with a deposition of a sodium biurate in the joints and other places, which is often accompanied by acute pain. As potassium biurate is more soluble than sodium biurate, potassium compounds have been given largely in this disease to prevent the deposition of biurate and increase its excretion.

The action of the potassium-ion is of small importance therapeutically. Pharmacologically it is a muscle poison, and if perfused through a heart (say as potassium chloride) has a marked toxic effect on this organ. But no such action is demonstrable in man after ordinary doses. The potassium-ion is, however, to some extent foreign to the body fluids, and is consequently more of an irritant than the sodium-ion. Thus during excretion it stimulates the excretory organs more, and potassium compounds are therefore better diuretics, expectorants, &c., than the corresponding sodium compounds. The rate of absorption of the potassium salts is about the same as that of sodium salts.

**Potassa Caustica.**—'Potassium hydroxide, KOH, with not more than 10 per cent. of combined water and impurities.'

Prepared by adding excess of calcium hydroxide to a boiling dilute solution of potassium carbonate, decanting the clear solution when it has ceased to effervesce with acids, and evaporating.

*Characters.*—Hard white sticks or cakes, very deliquescent and powerfully alkaline. Soluble in about half its weight of water, and in about 3 parts of alcohol. It absorbs carbon dioxide from the air.

It usually contains sulphates, chlorides, and carbonates, but should contain no metallic impurities (lead, copper, arsenium, &c.). The purest form is obtained by dissolving the crude substance in alcohol, filtering and evaporating, and is labelled 'by alcohol.'

*Pharmacology.*—Its action is dependent on its powerful alkaline action, and its moderately powerful affinity for water. It can be handled with safety, but if rubbed into the skin it kills the tissues with which it comes into contact. This it does mainly in virtue of its powers of altering albumen and abstracting water. The altered albumen (alkali albumen) has a somewhat pultaceous consistence, and does not prevent the further diffusion of the caustic alkali dissolved in the tissue fluids. Hence its caustic action is diffuse. For this reason it was combined with lime or other substance to limit its action when its caustic effect was required. It is rarely used now.

Strong solutions possess a mild caustic or powerful irritant action according to the susceptibility of the tissue to which they are applied. They soften epidermal structures, and are sometimes used for this purpose in cases of ingrowing toe-nail and certain skin diseases. The official liquor is strong enough for most purposes.

When swallowed in moderate quantities caustic potash produces the symptoms of corrosive poisoning. In small quantities it exerts an alkaline action.

**Liquor Potassæ.**—An aqueous solution containing 5·85 per cent. by weight of potassium hydroxide.

*Characters.*—A colourless, transparent liquid, without odour, but having a bitter, acrid taste. It is strongly alkaline.

It should contain not more than traces of carbonates, chlorides, or sulphates, and no other impurity.

*Dose.*—10 to 30 minims, freely diluted.

*Pharmacology.*—It possesses in an almost pure form an alkaline pharmacological action. When applied to the skin



it acts (with friction) as a cleansing agent, saponifying the fatty matter and softening the epidermis. It has a soapy feel. If left in contact with the skin for long it irritates. If applied in a diluted form it is sedative. On mucous membranes its irritant action is more marked. Taken by the mouth in full doses, diluted, it has a somewhat unpleasant soapy taste, and on reaching the stomach increases the alkalinity, or diminishes the acidity, of the gastric contents. In the former case it helps to dissolve the mucus lining the gastric wall. In the latter case it may diminish or temporarily stop digestion. Directly or indirectly it increases the alkalinity of the blood, and, through this, of the various excretions. Thus the urine is rendered alkaline, and the bronchial mucus, in cases of bronchitis, is made less tenacious.

Weak solutions are useful for relieving itching in various forms of skin disease. Stronger solutions are valuable in certain chronic skin affections, but soft soap is more generally useful. It is employed for softening ingrowing toe-nail previous to excision. Internally, it is very rarely given, potassium carbonate or bicarbonate being generally preferred.

**Potassii Carbonas.**—Potassium carbonate,  $K_2CO_3$ , associated with one to one and a half molecules of water.

Prepared from the ashes of wood (potashes) and other products by lixiviation and calcination, or from crude potassium sulphate by the action of calcium carbonate and carbon, as in the Leblanc soda process.

*Characters.*—A white crystalline, deliquescent powder, with a sharp, bitter, nauseous taste. Soluble in less than its weight of water, insoluble in alcohol.

It may contain traces of chlorides and iron, but should contain no other impurity.

It is used in preparing Decoctum Aloes Compositum, Liquor Arsenicalis, Mistura Ferri Composita, and Unguentum Potassii Iodidi. For neutralising equivalents see footnote, page 99.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Similar to sodium carbonate. The potassium salt is somewhat more powerful, since it contains less water of crystallisation and has a greater affinity for water.

In contradistinction to sodium carbonate, it is frequently given internally. It is the most powerful alkali commonly so administered. It increases the alkalinity of the blood and urine, increases and renders somewhat less tenacious the bronchial mucus, and has other less important general actions.

It may be used externally in place of other alkalies, and internally in the treatment of gout, rheumatism, bronchitis, and conditions where it is desirable to render the urine alkaline, but for internal use less powerful salts are generally preferred.

### **Potassii Bicarbonas**— $\text{KHCO}_3$ .

Prepared by passing carbon dioxide into a strong aqueous solution of potassium carbonate.

*Characters.*—Colourless, transparent crystals, or a white crystalline powder, with a saline, feebly alkaline taste. Soluble in less than 4 parts of water, insoluble in alcohol. It is not deliquescent.

It should give only the slightest reactions for iron or for chlorides. For neutralisation equivalents, see footnote (page 99).

*Dose.*—5 to 30 grains.

*Pharmacology.*—Similar to that of sodium bicarbonate. It has a somewhat more unpleasant taste, but possesses no other essential points of difference except those connected with the action of the kation, potassium. It is given internally in the same class of cases as potassium carbonate, and, as it is much less alkaline and less unpleasant to take, is generally preferred to this compound.

### **Potassii Acetas**— $\text{CH}_3\cdot\text{COOK}$ .

Prepared by neutralising acetic acid with potassium carbonate and simply evaporating to dryness or carefully fusing the product.

*Characters.*—Colourless translucent foliaceous satiny masses, or pearly white tabular crystals, deliquescent, with a cool saline somewhat nauseous taste. Soluble in less than half its weight of water, and in two parts of 90 per cent. alcohol. Its aqueous solutions have an alkaline reaction.

It should contain not more than traces of chlorides or sulphates and no other impurity.

The alkalinity of potassium acetate solutions is due to partial hydrolysis. This normally occurs in compounds consisting of weak acids and strong bases.

*Dose*.—10 to 60 grains.

*Pharmacology*.—Its action is a combined saline action, alkaline action, and potassium action. Locally applied it is mainly saline, but after absorption into the blood the greater portion of the acetate-ions undergoes decomposition, being converted into carbonate-ion and water, and consequently the general action of this salt becomes in part an alkaline action similar to that of potassium carbonate and bicarbonate. It is, however, much weaker than these, and must be given in larger doses to obtain the same alkaline effect. It is a better diuretic on account of its greater saline action. It is used in the same class of cases as potassium carbonate and bicarbonate, and is to be preferred to these in most cases because it exerts no distinct alkaline effect upon the stomach, and does not therefore derange digestion to the same extent.

**Potassii Citras**— $C_3H_1 \cdot OH \cdot (COOK)_3$ .

Prepared by neutralising a solution of citric acid with potassium carbonate and evaporating to dryness.

*Characters*.—A white granular, deliquescent powder, with a cool saline taste. Soluble in less than its weight of water; insoluble in alcohol. Its aqueous solutions have an alkaline reaction.

It should contain only traces of chlorides or sulphates, and no other impurity.

*Dose*.—10 to 40 grains.

*Pharmacology*.—Very similar to that of potassium acetate. It is not, however, broken up to the same extent in the blood, therefore its alkaline action is somewhat weaker, and its saline action somewhat more marked. It is consequently a slightly better diuretic than potassium acetate.

It is the most commonly used of this class of potassium salts both on account of its pleasanter taste and because it deranges digestion least.

**Potassii Tartras**— $[(\text{CHOH})_2(\text{COOK})_2], \text{H}_2\text{O}$ .

Prepared by neutralising acid potassium tartrate with potassium carbonate.

*Characters*.—Small colourless crystals or white crystalline powder, with a saline somewhat bitter taste. Soluble in less than its weight of water; insoluble in alcohol. Its aqueous solutions are neutral.

It should contain only traces of calcium, magnesium, sodium, chlorides, carbonates, or sulphates, and no other impurity.

*Dose*.—30 to 240 grains.

*Pharmacology*.—Its action is similar in many respects to that of acetate and citrate of potassium, but more closely resembles that of sodium potassium tartrate (page 104). It is not readily absorbed from the intestinal canal, and therefore in large doses it acts as a saline purgative. Small doses are absorbed, and in part are broken up into carbonate and water. They consequently tend to alkalisise and increase the quantity of the urine. The wide difference between the minimal and maximal doses of the Pharmacopœia is due to these two actions. Small doses (30 to 60 grains) are intended to be diuretic; large doses (120 to 240 grains) to be purgative.

It is not much used.

**Potassii Tartras Acidus**—cream of tartar.

$(\text{CHOH})_2\text{COOH}\cdot\text{COOK}$ .

Prepared by decolourising and recrystallising argol, the crude acid potassium tartrate which is deposited during the fermentation of grape juice, and from the lees of wine.

*Characters*.—A white crystalline powder, or fragments of cakes crystallised on one surface, with an acid saline taste. Soluble in 220 parts of water, insoluble in alcohol.

The dried salt should not contain more than  $2\frac{1}{2}$  per cent. of impurities, which consist of calcium, magnesium, and sodium as tartrates, chlorides, and sulphates. It should contain no lead, iron, or copper.

It is contained in Confectio Sulphuris, Trochiscus Sulphuris, and Pulvis Jalapæ Compositus.

*Dose*. 20 to 60 grains.



*Pharmacology.*—Being an acid salt it has an acid action and a saline action. Taken by the mouth, it has a somewhat pleasant acid taste, and produces the effects of a mild acid in the mouth and stomach. In the intestines it is neutralised, and if in small amount is absorbed and acts as potassium tartrate. Large doses are purgative.

It is used to make ‘cooling drinks’ for feverish patients, to give a pleasant acidity to some medicines, and as a diuretic. It is too acid to use alone as a saline purgative.

### **Potassii Sulphas**— $K_2SO_4$ .

Prepared by purifying the native salt; or by the action of sulphuric acid on potassium chloride or carbonate; or from the potassium magnesium sulphate obtained from the Stassfurt salt, *kainite*, by interaction with potassium chloride.

*Characters.*—Somewhat opaque, colourless, hard crystals, with a slightly bitter saline taste. Soluble in 10 parts of water; insoluble in alcohol.

The salt can be readily distinguished by the six-sided pyramids which form the terminations of the crystals.

It should contain only traces of chlorides, and no other impurity.

It is contained as a diluent in two colocynth and two ipecacuanha preparations—*Pilula Colocynthis Composita*; *Pilula Colocynthis et Hyoscyami*; *Pilula Ipecacuanhæ cum Scilla*; *Pulvis Ipecacuanhæ Compositus*.

*Dose.*—10 to 40 grains.

*Pharmacology.*—Similar to that of sodium sulphate. It possesses no advantages over this salt, and is rarely used in therapeutics. In pharmacopœial doses it is mainly diuretic.

On account of its hard nature it is sometimes used in powdering fibrous drugs (mediate pulverisation).

### **Potassii Nitras**—nitre. Saltpetre. $KNO_3$ .

Prepared by purifying crude nitre; or by heating a strong solution of sodium nitrate and potassium chloride, separating the hot supernatant liquid from the deposited sodium chloride, and crystallising.

*Characters.*—Colourless, transparent, prismatic crystals or white crystalline masses, with a sharp saline taste. Soluble

in 4 parts of water, and in half its weight of boiling water ; insoluble in absolute alcohol.

It should contain no impurities.

*Dose.*—5 to 20 grains.

*Pharmacology.*—It has a typical saline action, but is more irritant than sodium chloride. This is due to the two ions, potassium and nitrate, being foreign to the tissue juices. It is more powerfully diuretic than sodium chloride, and was formerly much used for this purpose, but it is rarely used now.

Potassium nitrate is an ingredient of most asthma powders, pastilles, and papers. These are burned during asthmatical attacks and the fumes inhaled. The action, therefore, is not that of potassium nitrate, but that of the products of the combustion.

### **Potassii Chloras**— $\text{KClO}_3$ .

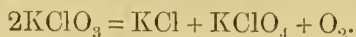
Prepared by passing chlorine into water in which lime or magnesia is suspended, treating the clear liquid with potassium chloride and separating the potassium chlorate by crystallisation ; also by an electrolytic method.

*Characters.*—Colourless crystals, with a slight cool saline taste. Soluble in 17 parts of cold and in less than 3 parts of boiling water ; insoluble in alcohol. It is a powerful oxidising agent.

When moistened with hydrochloric acid it gives off a yellow gas ('euchlorine'), consisting of a mixture of chlorine and chlorine peroxide.



When heated it fuses, gives off oxygen, and leaves a white residue, which consists of potassium chloride and perchlorate.



It should contain only traces of chlorides or sulphates, and no other impurity.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It has a saline action and a special action on the blood. These two actions largely explain its effects, but its action on mucous membranes is something more than a saline effect, and is not well understood. When added to

blood it changes the colour more or less quickly to chocolate-brown owing to the formation of met-hæmoglobin. The red corpuscles are changed (misshapen, colourless, &c.), and often are more or less broken down.

When taken internally in full pharmacopœial doses it has a saline taste, is generally well borne by the stomach, and usually produces no obvious effect except diuresis. In large doses it causes irritation of the alimentary canal, and after absorption affects the blood and produces cyanosis, dyspnoea, and various other symptoms dependent on the alteration of the blood. The saline action is again most evident in the renal symptoms. The cause of its action beyond its saline effect is unknown. Nearly the whole of it is excreted unchanged in the urine.

It is used largely in the treatment of inflammation and ulceration of the mouth and throat. It has been given internally in febrile and other diseases, but is of doubtful value.

**Trochiscus Potassii Chloratis.**—Each lozenge contains 3 grains. Rose basis.

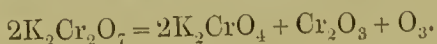
*Pharmacology.*—A convenient method of administering potassium chlorate in affections of the mouth and throat. To most people the combination with sugar is unpleasant. Simple compressed tablets of pure potassium chlorate are generally preferred.

**Potassii Bichromas**—potassium dichromate.  
 $K_2CrO_4, CrO_3$ .

Prepared by roasting crushed chrome-ironstone, potassium carbonate, and lime, with repeated exposure to air, treating the cooled product with a hot solution of potassium sulphate, and afterwards converting the chromate in solution into dichromate by the addition of sulphuric acid.

*Characters.*—Large, transparent, orange-red crystals with an acrid, somewhat bitter and metallic taste. Soluble in 10 parts of water; insoluble in alcohol. Its solutions are acid.

When heated beyond fusion it is decomposed into yellow potassium chromate, green chromic oxide, and oxygen.



On warming a solution with sulphuric acid and alcohol it turns a green colour, owing to the formation of chromic sulphate (or, rather, chrome-alum). An aqueous solution gives, with solution of silver nitrate, a purplish-red precipitate of silver chromate, soluble in dilute nitric acid; and with solution of barium chloride a yellowish-white precipitate of barium chromate, also soluble in dilute nitric acid. On adding a few drops, acidified with acetic acid, to solution of hydrogen peroxide, a blue colour is produced (see page 76).

It should contain no impurity.

*Dose.*— $\frac{1}{10}$  to  $\frac{1}{5}$  of a grain.

*Pharmacology.*—As in the case of chromic acid, its action depends upon its oxidising properties, its acid reaction, and its action as a compound of a heavy metal. It is a powerful irritant and a moderately powerful antiseptic. The irritant action is demonstrated by the ulceration of the nasal mucous membrane ('chrome holes') often seen in the employees in chromate works. Taken by the mouth, even in moderate doses, it produces symptoms of irritant poisoning.

In pharmacopœial doses it is useful in certain chronic gastric affections.

### **Potassii Permanganas**— $K_2Mn_2O_8$ .

Prepared by fusing potassium chlorate, potassium hydroxide, and manganese dioxide, dissolving the manganate in boiling water, and, after passing in carbon dioxide (or adding sulphuric acid) to neutralise the potassium hydroxide and thus increase the yield, crystallising.

*Characters.*—Dark-purple slender prismatic iridescent crystals, with a sweet, afterwards astringent, taste. Soluble in 18 parts of water, forming a deep-purple neutral solution. It is a powerful oxidising agent both in acid and alkaline solution.

When heated to redness the crystals decrepitate, give off oxygen, and leave a black residue of potassium oxide and manganese dioxide. On the addition of water potassium hydroxide is formed.

It should contain no impurity.

*Dose.*—1 to 3 grains.

*Pharmacology.*—It is disinfectant owing to its oxidising power. Living protoplasm immediately decomposes it, and the oxygen (in the so-called nascent state), reacting with the



protoplasm, inhibits its function or kills it. On account of the rapidity with which it is decomposed, it has, however, very little penetrating power. When applied to skin it produces a deep-brown stain.

Taken by the mouth it has an unpleasant taste, stains the buccal mucous membrane, and is completely decomposed in the mouth and stomach. Its further action, which is very slight, is that of a salt of manganese.

It is used in solution as a disinfectant for drains, typhoid stools, &c.; and as a disinfectant wash to foul ulcers and infected conditions of easily accessible cavities. It is also useful as a deodorant wash to the nose in ozæna. It is employed to wash out the stomach in cases of opium, phosphorus, and cyanide poisoning, because it oxidises these substances and renders them less toxic. It cannot, however, be relied upon if simply administered by the mouth. It has been given internally for certain uterine and other affections, but is of doubtful value.

**Liquor Potassii Permanganatis.**—A 1 per cent. solution of potassium permanganate in distilled water.

*Dose.*—2 to 4 fluid drachms.

It is a convenient solution of potassium permanganate.

**Potassii Bromidum.**—See page 84.

**Potassii Iodidum.**—See page 80.

**Potassa Sulphurata.**—See page 91.

**Sapo Mollis** (potassium oleate).—See page 555.

## LITHIUM

Lithium salts were introduced for the treatment of gout and gravel, lithium biurates being more soluble than potassium or sodium biurates. They do not, however, in the doses usually given, appear to be more efficacious than potassium salts.

The action of the lithium-ion is very similar to that of the potassium-ion.

**Lithii Carbonas**— $\text{Li}_2\text{CO}_3$ .

Prepared by adding sodium carbonate to a solution of mixed chlorides obtained from petalite, spodumene, or lapidolite—three rare minerals containing lithium.

*Characters.*—A white powder, or in minute crystalline grains. Soluble in about 75 parts of water, insoluble in alcohol. Its aqueous solution has an alkaline reaction.

It should contain only traces of calcium or sulphates, and no other impurity. The Pharmacopœia requires that it should contain 98·5 per cent. of the pure carbonate.

*Dose.*—2 to 5 grains.

*Pharmacology.*—Similar to that of potassium carbonate. The slight differences which exist are dependent mainly on the smaller solubility of lithium carbonate and the low atomic weight of lithium.

It is used both externally and internally in the treatment of gout—externally, as a lotion to gouty ulcers. It is also given in uric acid gravel. It possesses, however, in the doses recommended by the Pharmacopœia, no decided advantages over potassium carbonate.

**Lithii Citras**— $\text{C}_3\text{H}_4\cdot\text{OH}\cdot(\text{COOLi})_3, 4\text{H}_2\text{O}$ .

Prepared by neutralising a solution of citric acid with lithium carbonate, and crystallising.

*Characters.*—A white crystalline deliquescent powder with a cool saline taste. Soluble in less than twice its weight of water.

It should contain 98·5 per cent. of pure lithium citrate, and, except traces of calcium or sulphates, no impurity.

*Dose.*—5 to 10 grains.

It contains only about half as much lithium as the carbonate, hence the dose is twice as great.

*Pharmacology.*—Similar to that of potassium citrate. It possesses the advantages over lithium carbonate of being much more soluble in water and of being a neutral salt, but these are unimportant in the doses recommended by the Pharmacopœia. It is used in the same diseases as the carbonate.

**Lithii Citras Effervescens.**—An effervescing granular mixture containing 5 per cent. of lithium citrate.

Sodium bicarbonate, 58; tartaric acid, 31; citric acid, 21; lithium citrate, 5. The product should weigh 100.

*Dose.*—60 to 120 grains.

*Pharmacology.*—It is a pleasant method of administering lithium citrate. The sodium citrate and tartrate which are formed act mainly as diuretics and as alkalisers of the urine.

### AMMONIUM

Ammonium compounds differ from sodium and potassium compounds much more pharmacologically than they do chemically. This is due largely to the fact that the ammonium radical is not a simple element, and therefore it is possible for it to undergo changes within the body. It is, indeed, converted into urea. Ammonium salts also penetrate into cells with greater ease than the corresponding salts of sodium or potassium. They are therefore absorbed more quickly. Other differences, more especially connected with the hydrate, will be noticed below.

When injected into the blood of animals, ammonium chloride (*i.e.* the ammonium-ion) powerfully stimulates the central nervous system, especially the spinal cord and medullary centres. This does not occur when the salt is given by the mouth, probably owing to an insufficiency of the ammonium-ion being present in the blood at any one time. It is therefore not observed in man. The explanation is probably a slower absorption accompanied by a concurrent excretion and transformation into urea.<sup>1</sup> In most other respects ammonium chloride acts as a saline.

**Liquor Ammoniae Fortis.**—‘An aqueous solution containing 32·5 per cent. by weight of ammonia,  $\text{NH}_3$ .’

<sup>1</sup> Ammonium chloride is apparently excreted as such in the urine of carnivores after administration, but in reality the original ammonium is converted into urea. The ammonium excreted is derived from the tissues.

• It may be obtained by heating a mixture of ammonium chloride and slaked lime, and passing the resulting ammonia into distilled water.'

*Characters.*—A colourless, mobile liquid with a characteristic powerfully irritating odour. It is strongly alkaline.

It should contain no tarry matters (generally to be smelt, if present, after neutralising the ammonia with hydrochloric acid), and no other impurities except traces of chlorides.

*Pharmacology.*—Three marked differences distinguish ammonium hydroxide from the hydroxides of sodium and potassium—(i.) it is a weaker alkali; (ii.) it is very volatile, decomposing and giving off ammonia gas at all ordinary temperatures; (iii.) after absorption into the blood it undergoes chemical change.

The alkalinity of ammonium hydroxide as compared with that of sodium and potassium hydroxides is very small. In fortieth normal solution (about 1 of strong liquor in 760) the ionisation, taking sodium and potassium hydroxides as 100, of ammonium hydroxide is 2. In this weak solution the alkalinity of sodium and potassium hydroxides is fifty times greater than that of ammonium hydrate. In stronger solutions the difference is greater. Ammonium hydroxide, therefore, does not, apart from its power of neutralising acids, exert a powerful alkaline pharmacological action. This action, indeed, is largely masked by its other effects.

As ammonium hydroxide dissociates with difficulty, its main action is that of the intact molecule. The action of this is irritant or stimulant, according to the strength of the solution, and the effects it produces are largely due to its permeability. When strong ammonia liquor is applied to the skin in a closed vessel (*e.g.* a thimble) it penetrates through the external protective layer and irritates the underlying tissues (blood-vessels, &c.), and the result is a blister. If applied in a more dilute form, a milder irritation, manifesting itself in simple redness, results.

A similar irritant action occurs when ammonia (given off by the hydroxide) is sniffed or inhaled. The ammonia, as soon as it meets the tissue fluids, is converted into the hydroxide, and an irritant action, more especially on the nerve-



endings, results. The effects are largely reflex, and vary with the strength of the ammonia and the part mainly affected. If a dilute solution is sniffed, the terminations of the fifth nerve are irritated, and the medullary centres are reflexly stimulated. If, on the other hand, a strong solution is inhaled, the irritation of the nose and throat is so great that the glottis is closed, respiration ceases, and temporary collapse may supervene.

When taken by the mouth in small doses well diluted, it has a stimulant effect upon the mouth and stomach and reflexly on the medullary centres. If not quickly neutralised it is rapidly absorbed and directly stimulates the heart and medullary centres. It is converted into urea by the liver, and is excreted as such in the urine. It does not make the urine alkaline. If neutralised in the stomach its further action is that of, for all practical purposes, ammonium chloride.

The strong solution of ammonia is not used much therapeutically. It is sometimes employed to blister patients suffering from Bright's disease when counter-irritation is considered necessary. In these cases preparations of cantharides are, to some extent, contra-indicated.

**Linimentum Camphoræ Ammoniatum.**—An alcoholic solution containing camphor (about  $\frac{1}{8}$ ) and strong solution of ammonia ( $\frac{1}{4}$ ).

Strong solution of ammonia, 5 fl. oz.; camphor,  $2\frac{1}{2}$  oz.; oil of lavender, 1 fl. dr.; alcohol (90 per cent.), to make 20 fl. oz.

*Pharmacology.*—A powerful stimulating liniment.

**Linimentum Hydrargyri** (see page 181).

**Spiritus Ammoniæ Aromaticus** — spirit of sal volatile. An alcoholic solution containing ammonium carbonate and strong solution of ammonia, and flavoured with oil of nutmeg and oil of lemon. It contains 2·4 per cent. available  $\text{NH}_3$ .

Ammonium carbonate, 4 oz.; strong solution of ammonia, 8 fl. oz.; oil of nutmeg,  $4\frac{1}{2}$  fl. dr.; oil of lemon,  $6\frac{1}{2}$  fl. dr.; alcohol (90 per cent.), 6 pints; distilled water, 3 pints.

The last four ingredients are mixed and 7 pints are distilled. A further 9 oz. is then distilled, and in this the ammonia solution and ammonium carbonate are dissolved. The two solutions are then mixed. This apparently unnecessary procedure produces a better preparation than simple solution and mixture. If prepared by the latter method, the solution rapidly darkens on keeping.

*Characters.*—A transparent, mobile, slightly yellowish liquid, with a pungent ammoniacal slightly aromatic odour and taste. It is liable to darken somewhat by keeping. When added to a moderate amount of water it forms an opalescent mixture owing to precipitation of the volatile oils.

*Dose.*—20 to 40 minims for repeated administration; 60 to 90 minims for a single administration.

*Pharmacology.*—Almost solely that of the available ammonia it contains. The oils and alcohol make it more pleasant and increase its carminative effects. Taken by the mouth in full doses diluted, it has a strong ammoniacal but not otherwise unpleasant taste. In the stomach it has a stimulating effect upon the gastric walls, and to a slight extent reflexly affects the medullary centres. It also regulates the movements of the stomach and acts as a carminative. It reacts with any acid present, and the carbonic acid liberated aids its carminative action. Its further effects are the same as those described above. Large doses produce vomiting.

It is the preparation most frequently used when ammonia is given internally. It is employed largely in chronic bronchitis, in gastric diseases, and as a cardiac stimulant when there is a tendency towards failure of the heart.

**Spiritus Ammoniaë Fetidus** (see page 528).

**Tinctura Guaiaci Ammoniata** (see page 517).

**Liquor Ammoniaë.**—‘An aqueous solution containing 10 per cent. by weight of ammonia,  $\text{NH}_3$ .’

Strong solution of ammonia, 1; distilled water, 2.

*Characters.*—Similar to, but less powerful than, the strong solution.

*Pharmacology.*—See page 123. It is not too strong to be gently sniffed by most people without serious effects. It may be given internally in doses of 10 to 20 minims diluted, but the aromatic spirits or ammonium carbonate is preferable.

**Linimentum Ammoniaë.**—Consists of solution of ammonia, 1; almond oil, 1; olive oil, 2; by volume.

*Pharmacology.*—A moderately strong stimulating liniment. Useful in the treatment of sprains and bruises, muscular pains, &c.

**Tinctura Ergotæ Ammoniata** (see page 448).

**Tinctura Opii Ammoniata** (see page 315).

**Tinctura Quininæ Ammoniata** (see page 296).

**Tinctura Valerianæ Ammoniata** (see page 492).

The ammonia in the ammoniated tinctures is purely of pharmacological importance.

**Ammonii Carbonas**—Sal volatile. ‘A variable mixture of ammonium hydrogen carbonate,  $\text{NH}_4\text{HCO}_3$ , with ammonium carbamate,  $\text{NH}_4\text{NH}_2\text{CO}_2$ .’

Prepared by subliming a mixture of ammonium sulphate or chloride with excess of calcium carbonate. If we assume that the normal carbonate is first formed and then loses water and ammonia, the conversion into carbamate and bicarbonate will be easily understood.



*Characters.*—Translucent crystalline masses usually effloresced on the surface, with a strong ammoniacal odour. Soluble in 4 parts of water. Absolute alcohol dissolves the carbamate but leaves the bicarbonate. Its aqueous solutions are alkaline. The effloresced salt, which consists of ammonium bicarbonate, should be scraped off before it is used for dispensing purposes.

It should contain no tarry matters (recognised by smell and colour after neutralisation with an acid and evaporating to dryness), and no other impurities except traces of chlorides or sulphates.

The official volumetric test shows that the carbamate and bicarbonate are present in nearly equi-molecular proportions.

*Dose.*—3 to 10 grains.

*Pharmacology.*—Its action is similar to that of ammonium hydrate. Ammonia gas is given off at all ordinary temperatures owing to decomposition of the carbamate. When sniffed, an act which can just be borne when the carbonate is fresh, there is marked irritation of the nasal mucous membrane and reflex stimulation of the medullary centres. Taken internally in pharmacopœial doses it stimulates the gastric mucous membrane; in larger doses it irritates and induces vomiting. After absorption it stimulates the heart and medullary centres, and the bronchial mucous membrane if relaxed. It is converted into urea and excreted as such.

It is used largely as a cardiac stimulant in various conditions. As its action is transient, it should be given in moderate doses at frequent intervals. It is of considerable service in chronic bronchitis with profuse expectoration. As ordinary 'smelling salts' it is used in fainting and other conditions where it is necessary to rouse the medullary centres.

**Spiritus Ammoniaë Aromaticus** (see page 124).

### **Ammonii Chloridum**— $\text{NH}_4\text{Cl}$ .

Prepared by passing the ammonia, obtained by distilling the ammoniacal liquor of gas-works with lime, into hydrochloric acid and purifying the product by sublimation.

*Characters.*—Colourless inodorous crystals, with a saline taste. Soluble in less than 3 parts of water; in 60 parts of 90 per cent. alcohol; and in 170 parts of absolute alcohol.

It should contain no thiocyanates or other impurity, except traces of iron and sulphates.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Its action is that of the ammonium-ion (page 122) and of a saline.



It is used in a finely particulate form (so-called vapour) as a mild stimulant to the nasal and bronchial mucous membranes in naso-pharyngeal and bronchial catarrh. For this purpose it is obtained by combining ammonia and hydrochloric acid gases in various forms of inhalers adapted for the purpose. It is also given in solution in full doses for neuralgia, but, although useful sometimes, it is a very uncertain remedy.

**Liquor Ammonii Acetatis**—Mindererus's spirit. An aqueous solution containing nearly 5 per cent. of ammonium acetate.

Prepared by neutralising a solution of 1 oz. of ammonium carbonate in distilled water with acetic acid, and adding distilled water to make 20 fl. oz.

It 'should be preserved in a green glass bottle,' presumably because this is free from lead.

*Dose.*—2 to 6 fluid drachms.

*Pharmacology.*—Similar in most respects to that of potassium acetate. It is mildly diaphoretic, expectorant, and diuretic, and is used mainly in the early stages of fevers, especially in children, and in bronchial catarrh.

**Liquor Ammonii Citratis.**—An aqueous solution containing about 15 per cent. of ammonium citrate.

Prepared by neutralising a solution containing  $2\frac{1}{2}$  oz. of citric acid in distilled water with ammonium carbonate, and adding sufficient distilled water to make 20 fl. oz.

It 'should be preserved in a green glass bottle' (see *Liquor Ammonii Acetatis*).

*Dose.*—2 to 6 fluid drachms.

*Pharmacology.*—Its action and uses are practically the same as those of the solution of ammonium acetate.

This solution is apparently stronger than that of the acetate, but this is due merely to the higher molecular weight of the citrate. The two solutions are almost equi-molecular, a necessary condition for equality in pharmacological, and therefore therapeutic, effect.

**Ammonii Phosphas**— $(\text{NH}_4)_2\text{HPO}_4$ .

Prepared by neutralising phosphoric acid with solution of ammonia and crystallising.

*Characters.*—Transparent, colourless, inodorous crystals, with a saline taste. Soluble in less than 2 parts of water, insoluble in alcohol.

It should contain only traces of iron, chlorides, or sulphates, and no other impurity.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Similar in some respects to ammonium chloride. It is less easily absorbed. It is used mainly in the treatment of gout and uric acid gravel on account of its solvent action on urates, but it is a very mild remedy.

**Ammonii Benzoas** (see page 244).

**Ammonii Bromidum** (see page 84).

COMPOUNDS OF THE METALS OF THE  
ALKALINE EARTHS

OF these, compounds of calcium and magnesium are alone official. Salts of strontium and barium are occasionally used in therapeutics, but they are unnecessary. The action of strontium salts closely resembles that of calcium compounds. Barium salts are much more poisonous. The barium-ion has a powerful effect on muscular tissue, producing prolongation of contraction resembling in many respects that obtained from veratrine.

Compared with the compounds of the metals of the alkalies, those of the alkaline earths differ most markedly in the insolubility of their hydroxides, carbonates, and certain other salts. These, therefore, cannot exert the same action as the compounds of the alkali metals. The carbonates and hydroxides have the same power of neutralising acids, but the carbonates being insoluble in water exert no other alkaline pharmacological action. The hydroxides are slightly soluble

in water, and these exert an alkaline action comparable to that of sodium or potassium hydroxide of similar strength.

The compounds of this group are less easily absorbed than those of the alkali metals.

### CALCIUM

The calcium-ion is non-toxic when given by the mouth ; it is, indeed, necessary for the vital processes of the body, and is therefore really a food. It is also necessary for certain ferment actions (coagulation of blood and rennet action on milk), and for building up the supporting structures of the body. For these purposes sufficient calcium exists in the food.

The calcium-ion has an astringent effect, and an action upon muscular tissue which is, however, mainly of pharmacological interest.

**Calx**—lime. Calcium oxide,  $\text{CaO}$ .

Prepared by calcining calcium carbonate in the form of chalk, limestone, or marble. That obtained from marble is the purest.

*Characters.*—Whitish, irregular, compact masses, with a powerful affinity for water. It absorbs moisture and carbon dioxide from the air. On the addition of somewhat less than its own weight of water it swells up, evolves much heat, and finally falls to a white powder (calcium hydroxide).

It may contain traces of sodium, potassium, magnesium, aluminium, iron, carbonates, chlorides, sulphates, phosphates, and silica. It should be kept protected from the air.

*Pharmacology.*—Lime has a powerful affinity for water, and when applied to mucous membranes or denuded surfaces exerts a caustic effect in virtue of this action. Its caustic action does not extend beyond the point of application. On the intact skin it has practically no action unless allowed to remain for some time.

It is rarely used in therapeutics. Formerly it was mixed with caustic potash or soda to limit the caustic action of these. It is sometimes employed as a disinfectant for faeces, &c., but must be used in large quantities.

**Calcii Hydras**—slaked lime.  $\text{Ca}(\text{OH})_2$ .

Prepared by the action of water on calcium oxide. It should be kept protected from the air, as it absorbs carbon dioxide and forms the carbonate.

*Characters.*—A whitish powder, with a somewhat bitter and astringent taste. Soluble in rather less than 1,000 parts of cold water, still less soluble in hot water. Its solubility in water is notably increased by the addition of sugar, and, to a less extent, of glycerin. Its solutions have an alkaline reaction.

It should contain no other impurities than those mentioned under *Calx*.

*Pharmacology.*—It is used almost solely in the form of the solutions (see below). As a powder its action is somewhat stronger than, but otherwise similar to, that of the carbonate. It may be used as an antidote in oxalic acid poisoning.

**Liquor Calcis**—lime water. A saturated solution of calcium hydroxide in distilled water. One fluid ounce contains the equivalent of rather more than  $\frac{1}{2}$  grain of calcium oxide.

Prepared by washing calcium hydroxide until free from chlorides, then shaking up with distilled water and allowing to stand at least 12 hours.

*Dose.*—1 to 4 fluid ounces.

*Pharmacology.*—Lime water has an alkaline action and the action of the calcium-ion. Externally it is sedative and mildly astringent. Taken by the mouth it has a somewhat unpleasant, bitter taste; it acts as an alkali in the stomach, neutralising acid if present; in the intestine it acts mainly in virtue of its calcium-ion. Small amounts are absorbed and may be utilised by the tissues. They tend to alkalis the urine. Large quantities are astringent to the intestinal mucous membrane, diminishing the secretions and inducing constipation.

Externally, lime water is used as an astringent and sedative in acute inflammations of the skin with exudation, as an injection in inflammatory conditions of mucous



membranes, and as an enema for threadworms in children. It is frequently added to the milk of infants to prevent the formation of large curds in the stomach, which irritate and produce vomiting, diarrhœa, and other symptoms. It acts by diluting the milk, and in virtue of its alkalinity and mild astringent action. Its astringent action on the intestine is useful if diarrhœa is present.

**Linimentum Calcis.**—Consists of equal volumes of lime water (solution of lime) and olive oil shaken together.

*Pharmacology.*—It is sedative and mildly astringent. It is used mainly in the treatment of burns, lint or cloths being soaked in the liniment and applied over the burnt part.

Lime water is contained in **Lotio Hydrargyri Flava** and **Lotio Hydrargyri Nigra**.

**Liquor Calcis Saccharatus.**—A solution containing 10 per cent. of sugar and the equivalent of nearly 2 per cent. (about 8 grains in one fluid ounce) of calcium oxide, by weight.

A compound is formed which has been misnamed a saccharate, although not a salt of saccharic acid. It might provisionally be termed a sucrate.

The solution should give no characteristic reaction for lead, and should be stored in lead-free glass bottles.

*Dose.*—20 to 60 minims.

*Pharmacology.*—Similar to, but more powerful than, **Liquor Calcis**. It has a very unpleasant, bitter taste. It is used when larger quantities of lime are required than can be conveniently administered as lime water, or where, as in older children, it is undesirable to dilute the milk to any considerable extent.

**Creta Præparata.**—‘Native calcium carbonate, freed from most of its impurities by elutriation.’

*Characters.*—Whitish, friable masses, usually bluntly conical in form, or a whitish, smooth powder. Insoluble in water.

It should contain no barium carbonate, and traces only of iron, aluminium, magnesium, phosphates, sulphates, and silica.

*Dose.*—10 to 60 grains.

*Pharmacology.*—Being insoluble in water, chalk has almost a purely protective action when applied externally. It readily takes up a little water, and is consequently a drying powder. It is also very mildly astringent. Administered internally it interacts with the acid of the stomach, neutralises it to a greater or less extent, and passes on into the intestine as chloride and probably other compounds. The form in which it exists in the intestines is unknown; it may be as bicarbonate. A small portion of the calcium is absorbed, but after large and moderate doses the greater part is discharged in the fæces. Its most marked action is an astringent one on the intestine; it diminishes secretion and induces constipation, and is given internally mainly for this purpose. Externally it is used as a dusting powder in acute dermatitis with exudation, and as a mild sedative and astringent ointment in various forms of skin disease.

**Mistura Cretæ.**—A mixture containing  $\frac{1}{4}$  ounce of prepared chalk in 8 fluid ounces.

Prepared chalk,  $\frac{1}{4}$  oz.; tragacanth, 15 gr.; sugar,  $\frac{1}{2}$  oz.; cinnamon water to make 8 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—It is used almost solely in the treatment of diarrhœa. The chalk is converted, to a greater or less extent, into a soluble calcium salt, probably the chloride or bicarbonate, which acts mainly as an astringent on the intestinal mucous membrane. The cinnamon water gives the mixture a pleasant flavour, and also acts as a carminative. The tragacanth is present simply to suspend the chalk.

**Pulvis Cretæ Aromaticus.**—A pinkish powder, containing nearly  $\frac{1}{4}$  of its weight of prepared chalk, with sugar and aromatic substances.

Prepared chalk, 11; cinnamon bark, 4; nutmeg, 3; cloves,  $1\frac{1}{2}$ ; cardamom seeds, 1; sugar, 25.

*Dose*.—10 to 60 grains.

*Pharmacology*.—Similar to chalk mixture. The four aromatic substances act mainly as carminatives. It is used chiefly in the treatment of diarrhœa in children.

**Pulvis Cretæ Aromaticus cum Opio**.—Consists of opium 1, aromatic chalk powder 39.

*Dose*.—10 to 40 grains.

*Pharmacology*.—It is somewhat more powerful than the simple aromatic chalk powder owing to the opium it contains, which also constipates. The opium also relieves pain (colic) better than aromatic substances. It should be given to weakly children with care.

**Hydrargyrum cum Creta**.—See page 179.

**Calcii Carbonas Præcipitatus**— $\text{CaCO}_3$ . Often called precipitated chalk.

Prepared by boiling mixed solutions of calcium chloride and sodium carbonate, and washing and drying the precipitate.

*Characters*.—A white, micro-crystalline powder. Insoluble in water.

It should contain only traces of magnesium or chlorides, and no other impurity.

*Dose*.—10 to 60 grains.

*Pharmacology*.—The same as prepared chalk. It is a purer form of calcium carbonate than prepared chalk, but as the impurities in the latter are no detriment, and as it is obtained in a finer state of division, it is generally preferred for therapeutic purposes. The purer precipitated form should be used if a solution of a calcium salt is required as in the following preparation.

**Syrupus Calcii Lactophosphatis**.—Contains 1 per cent. of calcium as a so-called lactophosphate.

Precipitated calcium carbonate is dissolved in diluted lactic acid; concentrated phosphoric acid is added, and the mixture triturated until the precipitate which first forms re-dissolves. Commercial orange-flower water and sugar are subsequently added, and the syrup made up to the proper bulk by the addition of distilled water.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is believed to influence nutrition in certain diseases, *e.g.* phthisis, accompanied by emaciation, and to supply a supposed lack of calcium salts in such diseases as rickets and osteomalacia. Its influence has been greatly overrated.

**Trochiscus Bismuthi Compositus.**—See page 161.

**Calcii Chloridum**— $\text{CaCl}_2, 2\text{H}_2\text{O}$ .

Prepared by neutralising hydrochloric acid with calcium carbonate, evaporating the liquid, and drying at a temperature not exceeding  $200^\circ\text{C}$ . At a higher temperature a chemical interaction occurs with the formation of an alkaline product.

*Characters.*—Somewhat translucent, colourless, crystalline pieces, very deliquescent, with a bitter, nauseous taste. Soluble in less than its weight of water, and in 3 parts of 90 per cent. alcohol.

It should contain only traces of magnesium, and no carbonate or other impurity. It is easily distinguished from chlorinated lime (often called chloride of lime) by the absence of smell and the fact that no irritating gas (see page 86) is evolved on the addition of hydrochloric acid.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It has (i.) a typical calcium-ion effect; (ii.) a greater or less saline action according to the strength of the solution. Applied externally it has an astringent action. Taken internally it has an unpleasant taste, but in full pharmacopœial doses it is usually well borne by the stomach, and produces no other obvious effects. It is absorbed from the upper part of the intestine and is excreted by the lower part of the intestine, and to a less extent by the urine. Recently it has been used chiefly to increase the coagulability of the blood in certain forms of hæmorrhage and in certain blood diseases (hæmophilia, purpura hæmorrhagica, &c.). It undoubtedly increases the coagulability of the blood outside the body, but it has little influence on the blood in the blood-vessels. It has, therefore, not proved of much benefit in these diseases.



**Calcii Phosphas** — tri-calcium ortho - phosphate.  
 $\text{Ca}_3(\text{PO}_4)_2$ .

Prepared by dissolving bone-ash in dilute hydrochloric acid and pouring the liquid into solution of ammonia, or by adding a solution of calcium chloride to a solution of sodium phosphate containing ammonia, in each case washing the precipitate and drying it at a temperature not exceeding  $100^\circ\text{C}$ .

*Characters.*—A light, white, amorphous powder, without odour or taste. Insoluble in water or alcohol, slightly soluble in water containing carbonic acid and in various saline solutions, readily soluble in dilute hydrochloric or nitric acid.

It may contain traces of chlorides.

*Dose.*—5 to 15 grains.

*Pharmacology.*—Calcium phosphate is of little therapeutic value. It was believed to be of use in the treatment of rickets and osteomalacia, but as these diseases are not due to a deficiency of calcium or phosphate in the food its employment has been almost abandoned. It acts as a mild alkali throughout the intestinal tract, but it is not much used for this purpose.

**Calcii Hypophosphis**— $\text{Ca}(\text{PH}_2\text{O}_2)_2$ .

Prepared by boiling a mixture of phosphorus, calcium hydroxide, and water, and crystallising.

*Characters.*—Colourless, pearly crystals, with a somewhat bitter, nauseous taste. Soluble in 8 parts of water, insoluble in cold alcohol.

If incinerated, the crystals ignite, owing to the formation of hydrogen phosphide and hydrogen; a reddish residue is left. If a solution of mercuric chloride is added to a solution of the hypophosphite a white precipitate which turns grey is formed. This results from the reducing action of the hypophosphite, calomel and then more or less free mercury being formed.

It should contain no impurities except traces of chlorides, sulphates, phosphates, or phosphites. The last are almost always present.

*Dose.*—3 to 10 grains.

*Pharmacology.*—Its action and uses are practically the same as those of sodium hypophosphite (see page 108).

**Calx Chlorinata.**—See page 86.

**Calx Sulphurata.**—See page 91.

### MAGNESIUM

The action of the magnesium-ion, regarded from a therapeutic point of view, is purely local. If injected into the blood, magnesium salts produce weakness of the heart and certain other symptoms, but these never arise when the salt is given by the mouth. This is owing to the magnesium-ion being absorbed with difficulty. If magnesium chloride is taken in moderate doses it acts as a saline purgative; in small doses it is absorbed and produces diuresis. If the magnesium is associated with a difficultly absorbed anion, as in magnesium sulphate, the saline purgative effect is greater.

**Magnesii Sulphas**—Epsom salt.  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ .

Prepared from the native sulphate (kieserite), or by the action of sulphuric acid on native magnesium carbonates (dolomite or magnesite).

*Characters.*—Colourless, transparent, prismatic crystals, with a bitter, somewhat nauseous, taste. Soluble in its own weight of water, slightly soluble in alcohol.

It may contain traces of chlorides, but no other impurity.

*Dose.*—30 to 120 grains for repeated administration;  $\frac{1}{4}$  to  $\frac{1}{2}$  an ounce for a single administration.

*Pharmacology.*—It is a typical saline purgative. Externally it acts as a saline. When taken by the mouth it has a bitter, nauseous taste, and occasionally irritates the stomach, producing vomiting, but is generally well borne. It passes into the intestine, and by preventing absorption of fluid, inducing exudation if in markedly hypertonic solution, and stimulating peristalsis, it finally causes purgation. If taken in moderate doses before breakfast it produces a watery evacuation of the bowels in two to three hours. This is sometimes followed by a second, less frequently by a third, evacuation. If the dose is insufficient to purge, absorption occurs and diuresis results, but the repeated administration

of small doses usually produces a relaxed condition of the bowels.

It is used habitually as a purgative by many people. Its taste is somewhat objectionable, but is followed by a sweetish after-taste. It is one of the safest purgatives to use, and may be employed in almost all conditions in which a moderately rapid evacuation of the bowels is required. It is given in repeated doses as a laxative in hæmorrhoids and other rectal diseases, in lead colic, in hepatic diseases, in anæmia, and other conditions.

**Magnesii Sulphas Effervescens.**—A white, granular, effervescent mixture, containing the equivalent of half its weight of magnesium sulphate.

Prepared by partially dehydrating magnesium sulphate, 50; and adding sugar,  $10\frac{1}{2}$ ; sodium bicarbonate, 36; tartaric acid, 19; citric acid,  $12\frac{1}{2}$ ; and granulating. The product should weigh about 100.

*Dose.*—60 to 240 grains for repeated administration;  $\frac{1}{2}$  to 1 ounce for a single administration.

*Pharmacology.*—Practically the same as magnesium sulphate. The salts formed during effervescence have a saline purgative action, but are less powerful than magnesium sulphate, hence the larger dose of this preparation. The sugar in the preparation is objectionable to many people.

**Mistura Sennæ Composita.**—Contains 1 ounce of magnesium sulphate in 4 fluid ounces (see page 402).

**Magnesia Levis**—MgO.

Prepared by calcining light magnesium carbonate.

*Characters.*—A very light, white powder, with a slight unpleasant taste. Very slightly soluble in water, more soluble in water containing sugar.

It should not effervesce on the addition of acids, and should contain no impurity except traces of chlorides or sulphates.

May be contained in **Pulvis Rhei Compositus**.<sup>1</sup>

<sup>1</sup> Either heavy or light magnesia may be used to prepare Pulvis Rhei Compositus. Light magnesia is commonly used.

*Dose.*—5 to 30 grains for repeated administration ; 30 to 60 grains for a single administration.

**Magnesia Ponderosa**— $\text{MgO}$ .

Prepared by calcining heavy magnesium carbonate.

*Characters.*—A light white powder,  $3\frac{1}{2}$  times heavier than light magnesia, but similar in other respects to this.

May be contained in **Pulvis Rhei Compositus**.<sup>1</sup>

*Dose.*—The same as light magnesia.

*Pharmacology.*—The action of the two magnesias is the same. When added to water they are converted into the hydroxide, which is sufficiently soluble to impart a distinct alkaline reaction and a taste to the liquid. Applied externally they are protective and drying powders, but are not used for this purpose. Taken by the mouth they have a somewhat unpleasant taste, and after reaching the stomach they interact with the acid of the gastric contents, when present, and form a salt. In any case they enter into solution, to a greater or less extent, possibly as a bicarbonate, in the intestines, and their further action is largely that of a saline purgative. If given in large doses they sometimes induce distinct nausea, and, if repeatedly administered, the undissolved portions may accumulate within the intestine and form concretions. Their action is thus of two kinds : (a) an alkaline action, which, apart from their power of neutralising acids, is very slight, but is often continued down the intestinal tract ; (b) a saline purgative action.

The magnesias are used for both these purposes. They are generally employed to neutralise the acid in cases of corrosive poisoning from acids, since, owing to their insolubility in water, they can be given in excess without damaging further the gastric mucous membrane. They are also useful in arsenical, alkaloidal, and certain other forms of poisoning, but the gastric contents must be subsequently removed by washing out the stomach or by an emetic. For their purgative action they are frequently given to children.

<sup>1</sup> Either heavy or light magnesia may be used to prepare **Pulvis Rhei Compositus**. Light magnesia is commonly used.



**Magnesii Carbonas Levis.**—A hydrated carbonate, the composition of which may be conveniently represented by  $3(\text{MgCO}_3), \text{Mg}(\text{OH})_2, 4\text{H}_2\text{O}$ .

Prepared by the interaction of cold dilute solutions of magnesium sulphate and sodium carbonate, boiling the mixture for 15 minutes, washing and drying (at a temperature not exceeding  $100^\circ\text{C}$ .) the precipitate.

The pharmacopœial directions should be followed minutely, as different hydrated carbonates are produced under varying conditions.

*Characters.*—A very light white powder, practically insoluble in water.

When examined under the microscope it is seen 'to consist of amorphous particles with numerous slender prisms intermixed.' It should contain only traces of chlorides or sulphates, and no other impurity.

*Dose.*—The same as magnesia.

**Magnesii Carbonas Ponderosus.**—It has the same composition as the light carbonate,  $3(\text{MgCO}_3), \text{Mg}(\text{OH})_2, 4\text{H}_2\text{O}$ .

Prepared by mixing hot strong solutions of magnesium sulphate and sodium carbonate, evaporating to dryness, digesting for 30 minutes with boiling distilled water, and drying at a temperature not exceeding  $100^\circ\text{C}$ .

*Characters.*—A white granular powder.

It should contain no impurity except traces of chlorides or sulphates.

*Dose.*—The same as magnesia.

*Pharmacology.*—The action of the carbonates of magnesium differs only in one important point from that of the magnesias—on the addition of acids they effervesce, giving off carbon dioxide. This occurs in the stomach, consequently as carbonic acid is carminative, the carbonates are to be preferred to the oxides in gastric diseases. In the treatment of corrosive poisoning by acids, on the other hand, they are to be avoided, since distension of the stomach by the carbon dioxide produced might lead to serious consequences.

**Trochiscus Bismuthi Compositus** (see page 161).

**Liquor Magnesii Carbonatis**—'Fluid Magnesia.'  
A colourless, slightly effervescing solution, containing as bi-

carbonate the equivalent of about 2 per cent. of magnesium carbonate.

The early steps of its preparation are similar to those of the light carbonate. The washed light carbonate is then suspended in distilled water and washed carbon dioxide is passed into it, and afterwards kept in contact with it under a pressure of three atmospheres.

*Dose*.—1 to 2 fluid ounces.

*Pharmacology*.—Its action and uses are similar to those of magnesium carbonate. The presence of carbonic acid makes it more pleasant to take, and imparts to it a carminative action. It is not much used by the profession.

## COMPOUNDS OF OTHER METALS<sup>1</sup>

THE compounds of the metals of the earths and the heavy metals are best considered together. Their soluble salts possess one common characteristic, viz. the power of precipitating albumen from solutions, so that their local action is, in some respects, comparable. Their general action, *i.e.* their action after absorption or injection into the blood, is, however, different in almost every case. This action is due to the metallic ion (kation); the anion plays practically no part except in a few cases. The compounds of aluminium, zinc, copper, silver, lead, bismuth, cerium, and chromium are used only for their local effects; what general action some of them (silver, lead, bismuth) have is undesirable and to be avoided. The compounds of iron and mercury are used both for their local and their general actions.

When applied to the unbroken skin, the compounds of the heavy metals, with few exceptions, have no important action, but if applied to mucous membranes or denuded tissues the soluble compounds precipitate the albumen of the superficial cells and act as caustics or astringents, according to the preparation used and the part to which it is applied. The dividing line between a caustic and an astringent action is

<sup>1</sup> Arsenic and antimony are considered later.

difficult to draw. The same substance may produce one or other action according to the strength of the application. Thus silver nitrate applied pure is a powerful caustic; in dilute solution it is astringent. On the other hand, soluble compounds of mercury and of arsenium are caustic in a strong form, but in no dilution can they be considered astringent; while lead acetate, which is powerfully astringent, cannot be strictly regarded as a caustic. This difference in action cannot be entered into here, but it may be said that an astringent action is essentially superficial, while a caustic action is more or less deep, and is accompanied by more evident changes in the tissue affected. Thus a substance such as lead acetate, which cannot penetrate into tissues, is simply astringent; a substance such as mercuric chloride, which penetrates with ease, can only be caustic and in no strength astringent.

A caustic and astringent action can only be obtained from soluble substances. Substances such as kaolin, which are insoluble in water and other media, merely exert a protective action, and the nearer a substance approaches this type of insolubility the more protective and less active otherwise it is. Most of the so-called insoluble powders of the heavy metals are very slightly soluble in water and the tissue juices, and hence, along with a main protective action, exert also a very slight astringent effect.

When taken by the mouth, the soluble compounds of the heavy metals have an unpleasant metallic taste. In small doses, diluted, they are well borne by the stomach; in large doses they produce irritation, and, in most cases, other serious effects. Very few are absorbed from the alimentary canal in doses sufficient to produce distinct symptoms, and of these only the compounds of mercury are absorbed at all readily. The changes that metallic compounds undergo prior to absorption and their manner of absorption (except in the case of iron) are not known with certainty. Nor is it known in what form they circulate in the blood, except that, in most cases, it cannot be in an unaltered condition. They are commonly said to circulate as albuminates. They are excreted mainly by the lower part of the intestine.

All soluble simple salts of the heavy metals are disinfectant, owing to their power of precipitating albumen. A few (salts of mercury and silver) are powerfully disinfectant in virtue of a direct toxic action on bacteria.

### ALUMINIUM

The pharmacological action of the aluminium-ion is of no practical importance. The only official compounds of aluminium—potassium and ammonium alums ('alumen') and aluminium silicate ('kaolinum')—are used for their local effects. They are not absorbed to any appreciable extent.

**Alumen.**—'Aluminium and potassium sulphate (potassium alum),  $\text{Al}_2(\text{SO}_4)_3 \cdot \text{K}_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$ , or aluminium and ammonium sulphate (ammonium alum),  $\text{Al}_2(\text{SO}_4)_3(\text{NH}_4)_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$ .'

Prepared by adding to a solution of aluminium sulphate, obtained from alum-stone or alum-shale, the proper proportion of potassium sulphate or ammonium sulphate, and crystallising.

*Characters.*—Colourless, transparent crystalline masses, with a sweetish astringent taste. Ammonium alum is soluble in less than 10 parts of water, and in  $1\frac{1}{4}$  parts of glycerin. Potassium alum is not quite soluble in 10 parts of water, and is soluble in 3 parts of glycerin. Both alums are very soluble in boiling water, but insoluble in alcohol. Their solutions have an acid reaction.

It should contain not more than traces of iron, and no other impurity. The two official alums can be distinguished easily by chemical tests. The simplest method is to alkalisate a solution and heat. The ammonium alum gives off ammonia, the potassium alum does not.

*Dose.*—5 to 10 grains.

*Pharmacology.*—Alum acts partly in virtue of the acidity of its solutions, partly owing to the combined aluminium it contains. When applied externally, it has a well-marked astringent action, but if applied for long it irritates and produces inflammation. When taken by the mouth it has a sweetish taste, and acts as an astringent in the mouth, throat,



stomach, and intestine. Large doses (30 grains) irritate the stomach and produce vomiting. Still larger doses may produce severe inflammation of the gastro-intestinal tract.

It is used as an astringent, mainly to chronically inflamed mucous surfaces, *e.g.* stomatitis, pharyngitis, otorrhœa, leucorrhœa, &c. It is used sometimes in diarrhœa, in bleeding from the nose, and as an application (usually in combination with copper sulphate, as in 'lapis divinus') to indolent ulcerations. It is given occasionally in sweetened water, as an emetic in the treatment of croup and of acute bronchitis in children.

**Glycerinum Aluminis.**—Contains 1 ounce of alum in 6 fluid ounces.

*Pharmacology.*—The glycerin diminishes and prolongs somewhat the action of the alum. It is used mainly to apply to the mouth and throat in chronic inflammation or ulceration of these parts.

**Alumen Exsiccatum**—anhydrous potassium alum.

Prepared by heating potassium alum until the water of crystallisation is discharged. The yield is 54 to 55 per cent.

*Characters.*—Very light, large, easily friable porous masses, or a white powder, somewhat hygroscopic. Slowly soluble in 20 parts of water.

*Pharmacology.* It is powerfully astringent. On account of its avidity for water and its power of precipitating albumen, it may even be regarded as a mild caustic. It is used to destroy exuberant granulations.

**Kaolinum**—kaolin. China clay. A native hydrated aluminium silicate. It is freed from gritty particles by the process of elutriation.

It is formed from felspar by the natural process of weathering. During this the alkali of the felspar is dissolved out.

*Characters.*—A soft dirty-white powder, without taste or odour. Insoluble in water and most other solvents.

It may be decomposed by fusion with alkalis. On neutralising a solution of the product with a common mineral acid, a salt of aluminium remains in solution, and silica is deposited as a gelatinous precipitate.

It is an ingredient of *Pilula Phosphori*.

*Pharmacology*.—Being an insoluble powder, it acts simply as a protective and drying agent, and is used mainly for this purpose, either alone or in combination. Owing to its inertness it is often prescribed with readily oxidisable substances, such as phosphorus and silver nitrate, when these are ordered as pills.

## ZINC

The general effect of the zinc-ion is of no importance. Zinc compounds are not absorbed to any appreciable extent. They have been given in nervous diseases, but are of doubtful value. Locally applied, the soluble compounds act as caustics or astringents, and when taken internally in moderate doses induce vomiting. In large doses they cause gastro-enteritis.

### **Zinci Oxidum**— $\text{ZnO}$ .

Prepared by the combustion of metallic zinc, or by exposing zinc carbonate to a dull-red heat.

*Characters*.—A white, or nearly white, soft, tasteless, inodorous powder, becoming pale yellow when heated.

Prepared by combustion, it is white; prepared from the carbonate, it is 'nearly white.' It should contain no metallic zinc or other impurity.

*Dose*.—3 to 10 grains.

*Pharmacology*.—Externally applied, it is protective and very mildly astringent. Taken by the mouth, it is usually converted, wholly or in part, according to the dose, into the chloride in the stomach. In small doses it acts as an astringent to the gastric and intestinal mucous membranes. In large doses it produces nausea and vomiting.

It is mainly used externally in the treatment of skin diseases of an acute or subacute character. It has been given internally in epilepsy and certain other diseases, and for the night sweats of phthisis, but is of doubtful value. It has also been given in diarrhœa, but is rarely necessary.

**Unguentum Zinci.**—Consists of zinc oxide, 3 ; benzoated lard, 17.

*Pharmacology.*—A very mild astringent ointment ; used in the treatment of skin diseases.

**Zinci Carbonas**—zinc hydroxy-carbonate, having, approximately, the formula  $\text{ZnCO}_3(\text{ZnO}_2\text{H}_2), \text{H}_2\text{O}$ .

Prepared by adding a solution of zinc sulphate to a hot solution of sodium carbonate, boiling the mixture, and washing and drying the precipitate.

*Characters.*—A white powder, without taste or odour. Insoluble in water or alcohol, soluble in dilute mineral acids.

It should contain not more than traces of chlorides or sulphates, and no other impurity.

*Pharmacology.*—Its action and uses are practically the same as those of the oxide.

**Zinci Chloridum**— $\text{ZnCl}_2$ .

Prepared by dissolving zinc in hydrochloric acid, purifying the solution of lead, iron, and manganese, evaporating, and usually casting into rods.

*Characters.*—Small white rods (rarely in masses, tablets, or granular powder), extremely deliquescent, and caustic. In dilute solution it has an astringent, metallic, and sweetish taste. Soluble in less than half its weight of water, in less than its weight of alcohol, in 5 parts of glycerin, and readily in ether and some other organic solvents.

It should contain no impurity.

*Pharmacology.*—In the pure form, owing to its affinity for water and its power of precipitating albumen, it is a strong caustic, but its action is less circumscribed than that of most caustics in general use. It has been employed to destroy malignant ulcers, poisoned wounds, warts, nævi, &c., usually in the form of sticks made up with flour or other similar substance. It has also been used as a lotion or injection in the treatment of chronic inflammation of mucous membranes, but for this purpose it possesses no advantages over zinc sulphate.

It is not given internally. Large doses produce symptoms of corrosive poisoning.

**Liquor Zinci Chloridi.**—An aqueous solution containing about 50 per cent. by weight of zinc chloride.

Prepared by dissolving 1 lb. of granulated zinc in 44 fl. oz. of hydrochloric acid, slightly diluted; boiling; purifying, if necessary; filtering; and adjusting the final product so that it measures 2 pints.

*Characters.*—A colourless liquid with a powerful astringent and metallic taste.

Specific gravity, 1.530. It should contain no impurities.

*Pharmacology.*—It is powerfully astringent and disinfectant. In the form of Burnett's fluid (a stronger solution of zinc chloride) it has been used largely as a disinfectant for various domestic purposes. Its action depends mainly on its power of precipitating albumen; the zinc-ion itself does not possess any specific disinfectant action like the silver or mercury-ion. Diluted with ten or more times its volume of water, it is used to swab out the uterus after curetting, and for similar purposes to a dilute solution of zinc sulphate.

**Zinci Sulphas**—white vitriol.  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ .

Prepared by dissolving zinc in dilute sulphuric acid, purifying the solution, and crystallising; or by roasting native zinc sulphide (zinc blende), extracting with water, purifying, and crystallising.

*Characters.*—Transparent, colourless, prismatic crystals, with an astringent, nauseous, metallic taste. It effloresces slightly in air. Soluble in less than its weight of water; insoluble in alcohol.

It should contain no impurities except traces of iron or chlorides.

*Dose.*—1 to 3 grains as a tonic; 10 to 30 grains as an emetic.

*Pharmacology.*—It is a powerful astringent. When taken by the mouth it has a disagreeable astringent metallic taste, and in doses of 20 to 30 grains produces vomiting in a quarter to half an hour. The vomiting is due to an irritant action on the gastric mucous membrane. It is preceded by nausea,



but this quickly disappears after the vomiting ceases. It is said to be absorbed, but its absorption has not yet been definitely proved. Its supposed tonic influence on the brain is also doubtful.

It is used largely in the treatment of wounds and ulcers, especially in the form of the 'red lotion' of the hospitals. This is an aqueous solution of zinc sulphate, containing 2 grains to the fluid ounce, coloured with compound tincture of lavender. This strength is also a valuable application for inflammatory conditions of mucous membranes, such as gonorrhœa after the acute stage is passed, conjunctivitis, &c.

It is given by the mouth as an emetic, and is the safest and best all-round emetic that we possess. Children, however, do not take it readily. It has been given in epilepsy and other diseases, but it is of doubtful value in conditions requiring its absorption.

**Zinci Acetas** —  $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2, 3\text{H}_2\text{O}$ .

Prepared by neutralising acetic acid with zinc carbonate or oxide, and crystallising.

*Characters.*—Thin, colourless, pearly, crystalline plates with an acetous odour and an unpleasant astringent and metallic taste. Soluble in 3 parts of water; slightly soluble in alcohol.

As zinc acetate loses acetic acid on exposure, and is thereby converted into a basic acetate, complete solution may not be effected without the addition of acetic acid sufficient to replace that which has been lost.

It should contain no impurity.

*Dose.*—1 to 2 grains.

*Pharmacology.*—Similar to that of zinc sulphate. It has been given chiefly internally, but is of doubtful value for diseases requiring its absorption.

**Zinci Sulphocarbolas**—zinc phenol-para-sulphonate.  $\text{Zn}(\text{OH} \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_3)_2, 8\text{H}_2\text{O}$ . (The pharmacopœial formula contains only one molecule of water of crystallisation).

Prepared by heating a mixture of phenol and sulphuric acid, separating the phenol-sulphonic acid formed as the barium salt, decomposing this with a molecular quantity of zinc sulphate, and crystallising.

*Characters.*—Colourless, or nearly colourless, transparent tabular crystals or crystalline masses, efflorescent, without distinctive odour, but with an unpleasant metallic and astringent taste. Soluble in less than 3 parts of water or alcohol.

Like sodium sulphocarbolate, its aqueous solution gives a violet colour with solution of ferric chloride. It may be distinguished from the sodium salt by the taste and the white precipitate it gives with ammonium hydrosulphide.

It should contain not more than traces of sulphates, and no other impurity.

*Pharmacology.*—It is more antiseptic than zinc sulphate, but its action is otherwise similar. A dilute solution is used as an injection in gonorrhœa and allied conditions.

**Zinci Valerianas**— $\text{Zn}(\text{C}_5\text{H}_9\text{O}_2)_2$ . Mainly zinc iso-valerianate.

Prepared by saturating iso-valerianic acid with zinc oxide, or by the interaction of solutions of zinc sulphate and sodium iso-valerianate, and crystallising.

*Characters.*—White pearly tabular crystals, with a valerian-like odour and an unpleasant metallic taste. Soluble in about 120 parts of water; somewhat more soluble in alcohol.

It should contain no acetate, butyrate, or other impurity, except traces of chlorides or sulphates, and should yield from 26 to 30 per cent. of zinc oxide.

*Dose.*—1 to 3 grains.

*Pharmacology.*—Its local action is similar to that of zinc sulphate, but it is rarely used for the same purposes. It is given mainly in hysterical conditions, and in these the iso-valerianate-ion is of most importance. This acts largely through its unpleasant taste. In the stomach the salt is decomposed, and the iso-valerianic acid formed is subsequently absorbed, but it is doubtful if it exerts any action on the nervous system directly. The zinc-ion, which in this compound was believed to act as a nervine tonic, is not known to be absorbed.

**Unguentum Zinci Oleatis.**—Consists of equal weights of zinc oleate and soft paraffin.

The zinc oleate is prepared by the interaction of solutions of zinc sulphate (2 oz.) and hard soap (sodium oleate, 4 oz.); the precipitated zinc oleate is washed until free from sulphates, and dried.

*Pharmacology.*—It is a mild astringent ointment, useful in some forms of skin disease.

## COPPER

The action of the copper-ion is similar to that of the zinc-ion, but is more powerful. Soluble copper salts are therefore strongly astringent. When taken by the mouth, in small doses, they exert an astringent effect upon the mucous membrane of the alimentary canal, and in larger doses produce nausea and vomiting, and sometimes more serious effects. They are absorbed to a slight extent, but do not produce any symptoms. The effects described as resulting from the continued use of copper salts are due either to an effect upon the gastro-intestinal tract or to some other cause. The question has been much debated, because copper compounds are used to improve the colour of preserved vegetables, especially peas, and because copper utensils are largely used in cooking.

Only one copper salt is official.

**Cupri Sulphas**—blue vitriol. Blue Stone.  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ .

Prepared in various ways: by roasting the sulphide (obtained from scrap copper), extracting with water, and crystallising; or by the action of sulphuric acid on copper exposed to the air, or on cupric oxide (hammer-scales), and crystallising.

*Characters.*—Large blue crystals, with an unpleasant, powerfully astringent and metallic taste. Soluble in 3 parts of water and of glycerin; insoluble in alcohol. Its solutions have an acid reaction.

It should contain not more than traces of iron, and no other impurity.

*Dose.*—As an astringent,  $\frac{1}{2}$  to 2 grains; as an emetic, 5 to 10 grains.

*Pharmacology.*—It is a powerful astringent, mainly owing to its power of precipitating albumen. The precipitate formed has a blue colour, and consequently, when applied to denuded surfaces, it gives the part to which it has been applied a bluish appearance. The acidity of a solution (due to the anion being relatively stronger than the kation) also helps in the astringent effect.

Taken by the mouth, copper sulphate has an unpleasant, metallic, astringent taste. Small doses exert an astringent action on the small intestine and cause constipation. Doses of 10 grains cause nausea and vomiting in 10 to 30 minutes. Much larger doses may cause symptoms of irritant poisoning.

It is used mainly as an astringent application to exuberant granulations and chronic ulcers and in certain chronic conjunctival affections (tinea tarsi). In these cases a smooth crystal is gently drawn over the part. It is occasionally given by the mouth as a pill for severe diarrhoea, and is frequently used, especially on the Continent, as an emetic. It is the best emetic in cases of phosphorus poisoning, as the copper sulphate reacts with the phosphorus in the stomach and forms an insoluble copper phosphide.

## SILVER

Soluble simple salts precipitate albumen and chlorides, and consequently act as caustics. The caustic action, however, is very superficial. The cauterised portion is white at first, but gradually darkens to a brownish black on account of the reduction of the silver chloride and so-called silver albuminate to metallic silver. Solutions of simple silver salts are powerfully astringent.

Taken internally in large doses they produce symptoms of corrosive poisoning; in small doses they act as astringents on the buccal and gastric mucous membranes. They are converted in the stomach into a complex compound, possibly a double salt, which has no astringent action. A small quantity of silver in some form is absorbed from the intestine because after small doses of silver salts have been taken for some time



there appears a duskiness of the skin which gradually deepens, if the administration be continued, until the skin assumes a metallic greyish-brown colour. This condition is known as **argyria**. It is unaccompanied by any other symptoms.

Soluble silver compounds are powerfully bactericidal. For this purpose double salts or compounds which do not precipitate albumen are usually employed.

**Argenti Nitras**—lunar caustic.  $\text{AgNO}_3$ .

Prepared by dissolving silver in nitric acid, and crystallising.

*Characters*.—Large colourless tabular crystals, caustic, possessing in dilute solutions an astringent metallic taste. Soluble in less than its weight of water; slightly soluble in absolute alcohol and in pure ether. Its solutions are neutral.

The official tests require it to be practically pure.

*Dose*.— $\frac{1}{4}$  to  $\frac{1}{2}$  grain.

*Pharmacology*.—In the solid form it is a powerful superficial caustic; in solution it is astringent. It is also a powerful disinfectant, but as it combines with albumen and chlorides, and is thereby thrown out of action, its use for this purpose is limited. Taken by the mouth in dilute solution it has an unpleasant metallic taste, and acts as an astringent to the buccal, pharyngeal, and gastric mucous membranes. It is absorbed, probably as a double salt, to a very slight extent, and long-continued use leads to argyria, but produces no other symptoms. Large quantities produce symptoms of corrosive poisoning.

It is used as a caustic in the form of the official ‘toughened caustic’ (see below). As an astringent and disinfectant it is employed in purulent ophthalmia (often in 5 to 10 per cent. solutions). In weaker solutions ( $\frac{1}{4}$  to  $\frac{1}{2}$  per cent.) it has been used as an eye-wash to prevent gonorrhœal (purulent) ophthalmia in new-born babes, as an injection in inflammatory conditions of mucous canals or cavities (gonorrhœa, leucorrhœa, otorrhœa, &c.), and as an enema in severe diarrhœa (dysentery, &c.) In strong solution (10 per cent.) it is sometimes painted on a chronic pharyngitis and on weak or

infected (tuberculous) ulcers. It is given internally for gastric ulcer and chronic gastritis, and was formerly used in epilepsy, locomotor ataxy, and other nervous affections. There is no reliable evidence of its value in these diseases.

**Argenti Nitras Induratus**—toughened caustic. A mixture of 19 parts of silver nitrate and 1 part of potassium nitrate.

Prepared by fusing the mixed ingredients and pouring into proper moulds.

*Characters*.—White or greyish-white cylindrical rods, usually seen wrapped in black paper. Its solubility resembles that of silver nitrate.

One gramme should yield 0·8 gramme of silver chloride.

*Pharmacology*.—It has the caustic action of silver nitrate, and is used whenever this action is required. Pure silver nitrate is too brittle for use in the solid form.

It is employed to cauterise warts and small growths of various kinds, and has been applied to poisoned wounds, but as ordinarily used its action is too superficial to be efficacious. It is sometimes employed to stimulate the growth of chronic indolent ulcers and to destroy superficial infected ulcers.

**Argenti Nitras Mitigatus**—mitigated caustic. A mixture of 1 part of silver nitrate and 2 parts of potassium nitrate.

Prepared like toughened caustic.

*Characters*.—Similar to toughened caustic. It can be distinguished by estimating the amount of silver present.

Three grammes should yield 0·843 gramme silver chloride.

*Pharmacology*.—It is a weaker caustic than the preceding preparation, and may be used when a weaker effect is required.

**Argenti Oxidum**— $\text{Ag}_2\text{O}$ .

Prepared by adding a solution of calcium hydroxide to a solution of silver nitrate, washing and carefully drying the precipitate. At high temperatures it decomposes into silver and oxygen.

*Characters.*—A brown powder, insoluble in water. It readily parts with its oxygen, and decomposes, often with violence, when mixed with readily oxidisable substances (creosote, phenol, potassium permanganate, &c.).

It should contain no free silver or other impurity.

*Dose.*— $\frac{1}{2}$  to 2 grains.

*Pharmacology.*—It has no important external action. The changes it undergoes in the alimentary canal are unknown. It is absorbed to a slight extent, and when given for a lengthy period produces argyria. It has been used in the treatment of chronic gastric affections and in nervous diseases, but is of doubtful value in the latter.

## LEAD

Locally applied, the soluble salts of lead are powerful astringents; the insoluble compounds are mildly astringent. Taken internally, both kinds of compounds exert a strong astringent action on the alimentary canal and thereby cause constipation. They are absorbed to a slight extent, and after prolonged administration accumulate in the tissues. The metabolism of the tissues is thereby modified, and certain symptoms known collectively as **plumbism** or chronic lead poisoning are produced. The individual begins to feel unwell; there is loss of appetite, constipation, fœtid breath, and, after a short time, well-marked anæmia. Later—it may be weeks or months—severe attacks of colic occur, from which the patient almost invariably recovers, but which may recur again and again. Still later, curious forms of paralysis set in, of which the most common is the so-called ‘wrist drop.’ This is a paralysis affecting the extensors of the fingers and wrist except the supinator longus and extensor ossis metacarpi pollicis. It is bilateral. Rarer forms of plumbism are so-called *saturnine encephalopathy* (delirium or epileptiform convulsions often preceded by headache, giddiness, and insomnia), *saturnine arthralgia* (pains around joints), blindness, and other sensory affections. Plumbism is also a causal

factor of gout, renal disease, insanity, and other diseased conditions.

The cause of plumbism may be (i.) industrial, as in persons handling lead compounds (painters, plumbers, glaziers, &c.); or (ii.) accidental, as from the drinking of lead-contaminated water. The susceptibility of individuals varies.

One of the most important diagnostic features of plumbism is the 'lead line' on the gums. This is a dark-blue line, punctated in the early stages, situated just behind the junction of the teeth and gums. It is caused by sulphuretted hydrogen (arising from decomposition of food particles lodged between the teeth) reacting with the lead compounds deposited or circulating in the gums. It is consequently less marked in persons who keep the teeth clean than in those who do not.

### **Plumbi Oxidum**—litharge. $\text{PbO}$ .

Prepared by heating lead well above its melting point with free access of air. If heated just to melting point, 'massicot,' a monoxide of a lighter yellow shade, is produced.

*Characters*.—Pale yellowish-red, heavy scales. Almost insoluble in water, but readily soluble in dilute nitric or acetic acids. On exposure to air it gradually absorbs carbon dioxide and is converted into the carbonate.

It should contain no copper, iron, carbonate, or other impurity.

*Pharmacology*.—Its action is similar to that of the carbonate, but it is not used medicinally. It is employed solely to make lead plaster and other lead compounds.

**Plumbi Carbonas**—white lead. A hydroxy-carbonate having the formula  $2\text{PbCO}_3, \text{Pb(OH)}_2$ .

'May be prepared by the interaction of lead, water, and carbonic anhydride, in the presence of vapours of acetic acid.' This is the Dutch process. It gives a denser product than other methods of preparing the carbonate.

*Characters*.—A soft, heavy white powder, insoluble in water.

It should dissolve completely in dilute acetic acid, and should contain no zinc, calcium, or magnesium.



*Pharmacology.*—It is protective and mildly astringent (more astringent than other metallic carbonates) when applied externally. Taken internally it is converted into the chloride and acts like other soluble lead salts. It may be used as a dusting powder in acute or subacute skin diseases (weeping eczema, &c.) and in sweating of the feet, &c., but it is used mainly in the form of the ointment.

**Unguentum Plumbi Carbonatis.**—Consists of lead carbonate 1, white paraffin ointment 9.

*Pharmacology.*—It is used as a sedative and mild astringent ointment in various forms of skin disease.

**Plumbi Acetas**—sugar of lead.  $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2, 3\text{H}_2\text{O}$ .

Prepared by dissolving lead oxide or carbonate in acetic acid, and crystallising.

*Characters.*—Small white, prismatic crystals, or crystalline masses, slightly efflorescent, with an acetous odour and a sweet astringent taste. Soluble in less than 3 parts of water or of glycerin, and in 30 parts of alcohol. Aqueous solutions are slightly acid, and are clear or have only a slight milkiness, which disappears on the addition of acetic acid.

The pharmacopœial tests show that it is practically pure.

The acetous odour is due to the gradual liberation of free acetic acid, the salt being converted into a basic acetate. When dissolved in water such a salt produces an opalescent solution, which, however, becomes clear on the addition of acetic acid.

*Dose.*—1 to 5 grains.

*Pharmacology.*—It has a pure astringent action locally, and is solely used for this purpose. Taken by the mouth it has a sweet (hence its name ‘sugar of lead’) astringent taste, and exerts an astringent action on the mouth, pharynx, stomach, and intestine. The most manifest result is constipation. This salt, indeed, is one of the most powerful constipating agents we possess. It is sometimes used in the treatment of severe diarrhœa, but as it is badly borne by many people and tends to produce colic, it should be used with caution. It is given generally as the pill with opium.

It is sometimes used as an injection in gonorrhœa, and has been employed as an eye-wash, but owing to the fact that it tends to produce opacities, if corneal ulcers are present, its use has been abandoned.

**Unguentum Plumbi Acetatis.**—Consists of lead acetate 1, white paraffin ointment 24.

*Pharmacology.*—An astringent ointment used in eczematous eruptions and other inflammatory conditions of the skin and mucous membranes.

**Pilula Plumbi cum Opio.**—Contains lead acetate 6, opium 1, syrup of glucose  $\frac{2}{3}$ .

*Dose.*—2 to 4 grains.

*Pharmacology.*—A powerful intestinal astringent. The opium stops any tendency of the lead acetate to gripe, and also aids the constipating action of the latter. It is used only in severe cases of diarrhœa.

**Suppositoria Plumbi Composita.**—Each suppository contains lead acetate 3 grains, opium 1 grain.

*Pharmacology.*—They have a sedative and astringent action, and are used in the treatment of inflammatory conditions of the lower part of the rectum.

**Liquor Plumbi Subacetatis Fortis**—Goulard's extract. A liquor containing about  $17\frac{1}{2}$  per cent. of lead in the form of a subacetate, or about 23 per cent. of  $\text{PbO}, \text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$ .

Prepared by boiling lead acetate 5 oz. and lead oxide  $3\frac{1}{2}$  oz. (*i.e.* nearly molecular proportions) in 20 fl. oz. of distilled water, maintaining this volume of liquid by occasional additions of distilled water; filtering; when cold, adding sufficient distilled water to make 20 fl. oz.

*Characters.*—A clear colourless liquid, with an alkaline reaction and sweet astringent taste. It readily absorbs carbon dioxide from the air and becomes turbid, owing to the formation of the carbonate. With mucilage it forms an opaque white jelly.

Specific gravity, 1.275.

**Liquor Plumbi Subacetatis Dilutus** — Goulard's lotion, Goulard water. Contains 1 in 80 of the strong liquor.

Strong solution of lead subacetate, 1; alcohol, 1; distilled water, 78.

*Pharmacology.* — The strong solution is somewhat irritant, both on account of its alkaline action and the quantity of lead salt it contains. In a diluted form it is astringent and sedative. It is a most valuable preparation for the treatment of acute inflammation of the skin. For this purpose a lotion containing the strong liquor diluted with 20 or 30 times its volume of distilled water, with or without a little alcohol, is repeatedly applied. This strength is also of use as an injection for discharging mucous surfaces (gonorrhœa &c.). The official dilute solution is rather weak. It has been used to apply to the eye, but, as it may produce corneal opacity if ulcers are present, its use has practically been abandoned.

**Glycerinum Plumbi Subacetatis.**—A strong solution of lead subacetate in glycerin and water. It contains approximately 14 per cent. of lead as subacetate.

Prepared in a similar manner to the strong liquor. Lead acetate, 5 oz.; lead oxide,  $3\frac{1}{2}$  oz.; glycerin, 20 oz.; distilled water, 12 oz., are mixed and boiled together for 15 minutes; filtered, and evaporated below  $105.5^{\circ}\text{C}$ . to  $32\frac{3}{4}$  oz.

Specific gravity, 1.48.

It is used almost solely for making the ointment.

**Unguentum Glycerini Plumbi Subacetatis.**—Consists of glycerin of lead subacetate 1, white paraffin ointment 5.

*Pharmacology.*—It is a sedative and astringent ointment of considerable service in eczema and other forms of skin disease. Diluted with 9 parts of vaseline, it is a useful application for follicular conjunctivitis.

**Plumbi Iodidum**— $\text{PbI}_2$ . See page 81.

**Emplastrum Plumbi.**—Consists mainly of lead oleate.

Prepared by gently boiling lead oxide 1, olive oil 2, distilled water 1, on a steam bath for 4–5 hours, stirring constantly and adding more water as required. The water is necessary for the interaction to occur.

*Characters.*—A light-yellow mass, solid at the ordinary temperature of the air, but becoming soft and tenacious when gently warmed. It is usually sold in rolls about 6 inches in length and  $\frac{1}{2}$  lb. in weight. A thin layer spread on calico forms the common ‘sticking-plaster.’

Most other plasters are made from lead plaster (see page 22).

*Pharmacology.*—It has no important pharmacological action. It is used merely as a protective for small wounds, &c., and as a support in various surgical conditions.

## BISMUTH

The bismuth-ion is markedly toxic to living tissues, but this action does not come into play under ordinary conditions, because the simple compounds of bismuth are practically insoluble in water, and, when in solution, the bismuth-ion is only slowly absorbed. After continued administration of large doses, however, distinct symptoms are sometimes produced, the first of which is often slight soreness of the mouth and salivation. Various other symptoms—vomiting, diarrhoea, albuminuria, and rarely nervous and respiratory symptoms—occasionally follow. These effects have been produced most frequently by the application of bismuth compounds to large wounds. The acute form of bismuth poisoning described in older text-books is almost certainly arsenical poisoning due to contamination of the bismuth salt with some compound of arsenium.

Bismuth salts in solution when added to water form basic salts insoluble in water. The official carbonate, nitrate, and salicylate are basic salts. The official liquor contains bismuth probably in the form of a double salt.



**Bismuthi Oxidum**— $\text{Bi}_2\text{O}_3$ .

Prepared by boiling bismuth oxynitrate with solution of sodium hydroxide, washing and drying; or by burning bismuth in air.

*Characters.*—A pale brownish-yellow powder, without taste or odour. Insoluble in water, but soluble in nitric acid diluted with half its bulk of water.

It remains unchanged when heated in air. It should contain no arsenic, selenium, tellurium, or other impurity. The quantitative test shows that it is pure. Commercial samples, however, often contain traces of the oxynitrate.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Its action and uses are the same as those of the carbonate, which is much more frequently used. The oxide, owing to its colour, makes a somewhat pleasanter ointment.

**Bismuthi Carbonas**—bismuth oxycarbonate.  
 $(\text{BiO}_2\text{CO}_3)_2, \text{H}_2\text{O}$ .

Prepared by adding a solution of bismuth nitrate to a solution of ammonium carbonate, washing and carefully drying the precipitate.

*Characters.*—A white or yellowish-white powder, without taste or odour. Insoluble in water, soluble with effervescence in nitric acid diluted with half its bulk of water.

It should contain not more than traces of nitrates and no arsenic, selenium, tellurium, or other impurity. The official quantitative test shows that it is practically pure.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Applied externally it is almost solely protective. Taken by the mouth it acts, in the stomach, as an antacid and sedative; in the intestines as a mild astringent. It is not absorbed to any appreciable extent. It is converted in the stomach into the oxychloride, and in the intestines into the sulphide, and is excreted mainly as such. Consequently, it gives the fæces a blackish colour.

It is used largely in acute gastritis, gastric ulcer, and other gastric diseases, often combined with sodium bicarbonate. It is a useful adjuvant to other medicines in the treatment of

diarrhœa, but for other purposes the subnitrate is commonly preferred.

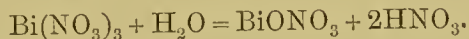
**Trochiscus Bismuthi Compositus.**—Each lozenge contains bismuth oxycarbonate 2 grains, heavy magnesium carbonate 2 grains, precipitated calcium carbonate 4 grains. Rose basis.

*Pharmacology.*—It is a useful antacid in a convenient form.

**Bismuthi Subnitras**—bismuth oxynitrate.

$\text{BiONO}_3 \cdot \text{H}_2\text{O}$ .

Prepared by throwing bismuth nitrate, obtained by dissolving bismuth in nitric acid, into a large volume of water, washing and carefully drying the precipitate.



*Characters.*—A heavy white micro-crystalline powder, without odour and practically without taste. Insoluble in water, but soluble in nitric acid. On standing in water it decomposes gradually into nitric acid and a more basic salt. Owing to this decomposition it is inadvisable to prescribe bismuth oxynitrate with carbonates.

A number of basic nitrates of bismuth have been prepared. The compound formed appears to be quite definite so long as the conditions are maintained—*i.e.* so long as the supernatant fluid contains the same amount of nitric acid.

It should contain not more than traces of carbonates, and no other impurity.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Applied externally it is protective, and, to moist surfaces, slightly antiseptic, owing to its slight decomposition. When taken by the mouth its action is the same as that of the carbonate, except that it is not antacid, and it is somewhat more astringent.

It is used externally as a lotion and ointment in acute skin diseases, as a substitute (not a good one) for iodoform in the treatment of wounds, and as a basis of snuffs for nasal catarrh. A mixture with water (1 in 10) is employed as an injection for gonorrhœa.

It is taken internally for the same conditions as the carbonate. It is generally believed to be somewhat more efficacious, especially in diarrhœa.

**Liquor Bismuthi et Ammonii Citras.**—Contains the equivalent of 5 per cent. of bismuth oxide as a complex compound.

Bismuth citrate is first prepared and is dissolved in a just sufficient amount of solution of ammonia. This is then diluted to the proper bulk.

*Characters.* — A colourless solution with a slightly metallic taste; slightly alkaline; freely miscible with water.

The liquors of different firms vary somewhat. Six different specimens examined by the author reacted in varying degree to sodium bicarbonate. In one a white precipitate immediately formed; in four others a greater or less precipitate formed at varying intervals; in one the solution remained clear more than a week. The variability is probably due to an insufficiency of citrate in the official formula.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is converted into oxychloride in the stomach, and its action is consequently very similar to that of the other preparations of bismuth.

**Bismuthi Salicylas**—bismuth oxysalicylate.  
 $C_6H_4 \cdot OH \cdot COOBiO$ .

Prepared by adding a solution of bismuth nitrate to a solution of sodium salicylate, washing and carefully drying the precipitate.

*Characters.*—A white or nearly white amorphous powder (it has been obtained crystalline), without odour, and practically without taste. Insoluble in water, but gradually dissociating in it, yielding free salicylic acid and a more basic salt.

On this account it is difficult to obtain pure, and commercial samples commonly contain traces of free acid. It should contain not more than traces of nitrates, and no other impurity.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Externally it is protective, and to moist surfaces slightly antiseptic owing to the liberation of a small

quantity of free salicylic acid. In the stomach it is wholly decomposed, if free acid is present, into salicylic acid and bismuth oxychloride, and its further action is that of these two compounds. If acid is not present, it is decomposed to a less extent.

It is a mild gastric antiseptic, but is used chiefly as an intestinal antiseptic. In most cases it can only act as such in the upper part of the intestine, owing to the rapid absorption of the salicylic acid (or, as this becomes neutralised, the sodium salicylate) formed.

### CERIUM

Only one salt of cerium is official.

**Cerii Oxalas**— $\text{Ce}(\text{C}_2\text{O}_4)_3 \cdot 10\text{H}_2\text{O}$ .

Prepared by adding an aqueous solution of an oxalate to an aqueous solution of a cerium salt, washing, and drying. It usually contains lanthanum and didymium oxalates. These metals occur in the cerite from which cerium is obtained.

*Characters*.—A white or almost white granular powder, without taste or odour. Insoluble in water; dissolved by boiling hydrochloric acid.

On incineration it yields a yellowish to reddish-brown powder which, if dissolved in boiling hydrochloric acid and potassium sulphate added, forms a white crystalline precipitate. (The formation of insoluble double sulphates is characteristic of some of the rare metals of the earths.) It should contain no impurity beyond those specified.

*Dose*.—2 to 10 grains.

*Pharmacology*.—It was introduced as a remedy for the vomiting of pregnancy, and, if frequently administered in full pharmacopœial doses, appears to be beneficial in some cases; but it often fails to alleviate the distress, and is comparatively little used at the present time.

### CHROMIUM

Chromium-ions have a similar action to other heavy metal ions. Only two compounds containing chromium are



official, and in both it forms part of the acidic radical. Both compounds have been described elsewhere.

**Acidum Chromicum** (see page 65).

**Potassii Bichromas** (see page 118).

#### MANGANESE

The only official compound containing manganese is potassium permanganate, in which the manganese occurs in the acidic radical. This is decomposed in the stomach, forming a salt of manganese, so that its further action may be attributed to the manganese-ions. These are believed to play a similar part to iron-ions in improving the blood of anæmia, but the evidence is not convincing.

**Potassii Permanganas** (see page 119).

#### IRON

The most important actions of the compounds of iron are (i.) an astringent action ; (ii.) a hæmatinic (blood-improving) action. The former is a purely local, the latter a general effect. Only those iron compounds which are capable of giving the characteristic reactions of iron (*i.e.* which contain in solution iron-ions) are able to act as astringents, and of these the soluble ferric salts are the most powerful and the only ones employed for this purpose in therapeutics. Compounds of iron which do not give in solution the tests for iron (*i.e.* which do not contain iron in an ionised form), as some double compounds and some complex organic compounds, are not astringent ; they do not precipitate albumen.

But all iron compounds, whether they contain iron in an ionised form or not, are probably able to act as hæmatinics, except a few which contain poisonous anions. In health, this hæmatinic action is not evident ; it is seen only in cases where there is a deficiency of hæmoglobin in the blood, and is best marked in chlorosis. In this condition iron compounds

are the staple remedies, and most of the preparations of iron in the Pharmacopœia are employed for the purpose. Besides these, numerous other compounds (substances obtained from blood, liver, eggs, so-called albuminates, &c.) containing unionised iron, are employed. The value of these and all the preparations of iron used for this purpose is dependent, not so much on the percentage of iron they contain, as on the amount which is assimilated. On this point—the assimilation of iron—there is some difference of opinion. It was said that inorganic preparations of iron were not absorbed, but, as it has been proved by both quantitative and microscopical investigation that they are, this point is now universally conceded. It is stated, however, that inorganic forms of iron are not assimilated, that they do not help to form hæmoglobin, but act by stimulating the blood-forming organs, or in some other way. This theory is not supported by the experimental evidence at present available, or by clinical observations. It is even doubtful if the so-called organic forms of iron (derivatives of hæmoglobin, &c.) are much more easily assimilated in disease than the simpler inorganic forms. They do, however, possess some advantages (less marked local action, therefore less tendency to derange digestion, greater proportionate assimilability, &c.) over the latter; but none are official in the Pharmacopœia, and consequently they need no consideration here.

The assimilation of iron by the body is very slow. Although the blood of an adult contains only about 3 grammes (46 grains) of iron combined in the form of hæmoglobin, it usually takes many weeks' administration of iron compounds to bring back a chlorotic patient to health. A great part of the iron administered is not absorbed, and, of the portion absorbed, part is excreted without taking part in any vital change. The changes undergone by iron during assimilation are largely unknown; there is even a difference of opinion regarding the changes occurring previous to absorption. As, however, iron can be detected in the epithelium and the lymph cells of the duodenum, in the mesenteric glands, spleen, and liver, by the ordinary tests, it is evident that the iron present in these cells

and tissues is in the ionic form as in solutions of the simple inorganic salts.

The course of absorption is from the duodenum mainly through the lymph channels into the blood. It is taken up by the spleen and the liver, and in the latter organ it probably undergoes the initial changes of its metabolism. It is excreted in part by the kidney, and may be detected by microchemical methods in the renal cells; but the greater part is excreted by the large intestine. This latter portion and any of the iron compound not absorbed by the intestine are converted into iron sulphide and excreted in the fæces. The fæces therefore when passed have a dark, almost black, colour.

The chief use of the compounds of iron is in anæmia. Nearly all the preparations of iron are used mainly for this purpose, and one preparation possesses comparatively little advantage over any other. The most important difference is connected with their local effect upon the alimentary tract; some producing gastric and even intestinal catarrh when repeatedly administered. In general it may be said that preparations of iron are of value in all anæmic conditions whatever the cause, providing that the cause has been removed. In anæmia due to continued discharges, insufficient nutrition, the presence of toxæmic conditions (syphilis, malaria, &c.), the administration of iron as a hæmatinic is of little value so long as the primary disease lasts. The best results are seen in chlorosis. In pernicious anæmia iron compounds are of little value.

The official compounds of iron may be classified into (i.) the metal and reduced iron; (ii.) ferrous salts, containing both soluble and insoluble compounds; (iii.) ferric salts, official as liquors; (iv.) a mixed class including iron phosphate and arsenate, which contain both ferrous and ferric forms; (v.) scale preparations, consisting of complex compounds in which the iron is present wholly or mostly in the ferric state.

All the official compounds and preparations are made directly or indirectly from the metal. Made directly from the metal are Vinum Ferri, Syrupus Ferri Phosphatis, Syrupus Ferri Phosphatis cum Quinina et Strychnina, Syrupus Ferri Iodidi, Ferri Sulphas (from which all other ferrous compounds, except the preparations just named, are made), Liquor Ferri Perchloridi Fortis, and Liquor Ferri Pernitratis. Liquor Ferri Acetatis and Liquor Ferri Persulphatis are made from ferrous sulphate.

**Ferrum.**—‘Annealed iron wire having a diameter of about 0·005 inch (0·1 millimetre), or wrought iron nails, free from oxide.’

**Vinum Ferri.**—Sherry containing about 0·2 per cent. of iron in the form of organic salts.

Prepared by nearly immersing iron wire 1 oz. in sherry 20 fl. oz. in a closed vessel, frequently shaking, and occasionally removing the stopper, and, after thirty days, filtering.

The iron is partially dissolved by the organic acids (tartaric and malic) and acid salts present in sherry. Solution is aided by the unsubmerged part becoming more or less oxidised. The strength of the preparation is somewhat variable, owing to the variable composition of sherry.

*Dose.*—1 to 4 fluid drachms.

*Pharmacology.*—It is a very mild preparation, and is comparatively little used. It is usually taken readily by children.

**Ferrum Redactum** — reduced iron. A mixture of metallic iron and oxide of iron. It should contain at least 75 per cent. of metallic iron.

Prepared by reducing ferric hydroxide by means of dry hydrogen. The hydroxide is heated to redness in a tube and the hydrogen is passed over it until aqueous vapour ceases to be formed. The tube is then allowed to cool, the stream of hydrogen being meanwhile continued.

*Characters.*—A greyish-black gritty powder without taste or odour. Insoluble in water, but dissolving in hydrochloric acid with the evolution of hydrogen. It is attracted by a magnet, and if firmly rubbed in a mortar leaves metallic streaks.

It should contain no sulphide. The solution in hydrochloric acid gives, with solution of potassium ferrocyanide, a light-blue precipitate, showing that the iron in solution is mainly in the ferrous state. A quantitative test, somewhat unsatisfactory, is given in the Pharmacopœia to show that the amount of metal present is at least 75 per cent. It is sometimes less, but often much more than this.

*Dose.* 1 to 5 grains.

*Pharmacology.*—It has a gritty feel in the mouth; in the stomach it is converted into the chloride, mainly ferrous



chloride. It is a mild preparation, and is used largely in the treatment of anæmia. It may be given as a powder or sprinkled on bread and butter, but is best administered in pills or pastilles.

**Trochiscus Ferri Redacti.**—Each lozenge contains 1 grain of reduced iron. Simple basis.

*Pharmacology.*—It is simply a means of administering reduced iron. The grittiness of most lozenges is objectionable to many people.

**Ferri Carbonas Saccharatus.**—‘Ferrous oxycarbonate,  $x\text{FeCO}_3$ ,  $y\text{Fe}(\text{OH})_2$ , more or less oxidised, mixed with sugar; the ferrous salt, if reckoned as carbonate,  $\text{FeCO}_3$ , forming about one-third of the mixture.’

Ferrous carbonate is an unstable salt, especially in the presence of moisture. When exposed to the air it is converted into the oxide. This change is retarded if the mass is intimately mixed with sugar.

Prepared by adding a dilute solution of ferrous sulphate (2 oz. in  $\frac{1}{2}$  gallon boiling distilled water) to a dilute solution of ammonium carbonate ( $1\frac{1}{4}$  oz. in  $\frac{1}{2}$  gallon boiling distilled water), with brisk stirring, covering and allowing to stand for 24 hours, washing by decantation, discharging excess of water by pressing in calico, mixing with sugar (1 oz.), and drying at a temperature not exceeding  $100^\circ\text{C}$ .

*Characters.*—A brownish-grey amorphous powder or small lumps, without odour, but with a slight sweet chalybeate taste. Insoluble in water, but dissolving, with effervescence, in hydrochloric acid.

It should contain only traces of sulphates.

*Dose.*—10 to 30 grains.

*Pharmacology.*—It is a mild preparation of iron. In the stomach it is converted into the chloride. It is given for anæmia, usually as a powder. The maximal official dose is unnecessarily large.

Two other preparations contain iron in the form of the carbonate—viz. *Pilula Ferri* and *Mistura Ferri Composita*.

**Mistura Ferri Composita**—Griffith's Mixture. An olive-green mixture containing nearly 2 grains of ferrous carbonate ( $\text{FeCO}_3$ ) in 1 fluid ounce. The ferrous carbonate is produced by the interaction of ferrous sulphate and potassium carbonate. The mixture also contains myrrh, sugar, spirit of nutmeg, and is made up with rose water.

Ferrous sulphate, 25 gr.; potassium carbonate, 30 gr.; myrrh, 60 gr.; sugar, 60 gr.; spirit of nutmeg, 50 minims; rose water, 10 fl. oz.

The ferrous carbonate first formed gradually decomposes, and if kept some time the mixture assumes a brown colour, owing to the formation of ferric hydroxide.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—Its action is mainly that of ferrous carbonate. The myrrh and spirit of nutmeg are aromatic and carminative, and the myrrh and sugar hinder the decomposition of the ferrous carbonate. It has a somewhat unpleasant taste, but it is a mild and efficacious remedy as far as the treatment of anæmia is concerned.

**Pilula Ferri.**—A pill containing 1 grain of ferrous carbonate in 5 grains of mass. The ferrous carbonate is produced by the double decomposition of ferrous sulphate and sodium carbonate.

Exsiccated ferrous sulphate, 150; exsiccated sodium carbonate, 95; gum acacia, 50; tragacanth, 15; syrup, 150; glycerin, 10; distilled water, 20.

Dried ferrous sulphate and sodium carbonate are used because the ordinary crystalline substances contain a considerable amount of water of crystallisation which would be set free after the interaction had occurred, and would make the mass too diffuent for making into pills.

This pill is the official representative of Bland's Pills. Unless coated it is liable to become too hard by keeping.

*Dose.*—5 to 15 grains.

*Pharmacology.*—That of ferrous carbonate. It is the preparation most commonly used in the treatment of chlorosis. The pills should be freshly made.

**Ferri Sulphas**—Ferrous sulphate.  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ .

Prepared by dissolving iron in dilute sulphuric acid, and crystallising.

*Characters.*—Pale bluish-green crystals, without odour, but with an astringent chalybeate taste. Soluble in less than 2 parts of water ; insoluble in alcohol.

Its aqueous solutions should be clear (absence of oxysulphate). It should contain no ferric compound or other impurity.

*Dose.*—1 to 5 grains.

*Pharmacology.*—It is somewhat astringent when applied externally, but is not used for this purpose. In a crude form it has been employed as a disinfectant (for fæces, &c.), but it has only a very mild disinfectant action. It is a more powerful deodorant, as it combines with the hydrogen sulphide produced during putrefaction. When taken by the mouth it has a mild astringent and marked chalybeate taste. It has a mild astringent action on the stomach, but very little astringent action on the intestine ; in full pharmacopœial doses it may, if repeatedly administered, cause slight diarrhœa. Part is absorbed, and acts like other iron compounds. The portion unabsorbed is converted into sulphide, possibly under some conditions into tannate, and is excreted in the fæces.

It is used chiefly, especially in combination with magnesium sulphate, in the treatment of anæmia.

**Ferri Sulphas Exsiccatus.**—Consists of  $\text{FeSO}_4, \text{H}_2\text{O}$  (at least 92·5 per cent.) and a little ferric oxysulphate, which is produced during the drying of the salt.

Prepared by heating ferrous sulphate until aqueous vapours cease to be given off. The yield is about 60 per cent.

*Characters.*—A whitish powder, with an astringent ferruginous taste. Slowly soluble in 5 parts of water.

*Dose.*— $\frac{1}{2}$  to 3 grains.

*Pharmacology.*—Apart from its slight affinity for water, its action is the same as that of ordinary ferrous sulphate. It is intended to be administered in the form of pills.

**Pilula Aloes et Ferri.**—A pill containing exsiccated ferrous sulphate 1, and Barbados aloes 2, in 9 of mass (see page 408).

*Pharmacology.*—The ferrous sulphate, besides acting like other compounds of iron, appears to aid the purgative effect of the aloes. It is a useful purgative pill in the treatment of anæmia.

**Syrupus Ferri Iodidi.**—An almost colourless syrup, containing 1 grain of ferrous iodide in 11 minims.

Prepared by digesting iodine and excess of iron wire with water, heating, and filtering while hot into a syrup previously prepared.

Ferrous iodide is unstable. It decomposes into ferric oxyiodide and free iodine. It is, however, fairly stable in the form of a syrup, as sugar retards the decomposition.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has the action of iron and of iodides. The amount of iodide which can be given by this preparation, however, is relatively small. It is used in the treatment of tubercular conditions (so-called scrofula) and in certain chronic rheumatic affections.

**Ferri Phosphas.**—‘A powder containing not less than 47 per cent. of hydrous ferrous phosphate,  $\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$ , with ferric phosphate and some iron oxide.’

Prepared by adding a solution of sodium phosphate to a solution of ferrous sulphate, sodium bicarbonate being added subsequently to neutralise the sulphuric acid produced by the reaction. The precipitate is washed with hot distilled water until free from sulphates, afterwards dried at a temperature not exceeding  $49^\circ\text{C}$ . The ferrous phosphate first formed undergoes partial oxidation during the processes of washing and drying.

*Characters.*—A slate-blue amorphous powder, without taste or odour. Insoluble in water or alcohol; soluble in hydrochloric acid.

It should contain no arsenic or other impurity.

*Dose.*—5 to 10 grains.

*Pharmacology.*—It has a mild iron action; the phosphate portion of the molecule has no important influence. It may be used in the treatment of anæmia, but it is not frequently administered.



Two syrups contain ferrous phosphate. Both are prepared from iron wire directly.

**Syrupus Ferri Phosphatis.**—A syrup containing the equivalent of 1 grain of anhydrous ferrous phosphate in 1 fluid drachm.

Prepared by dissolving iron wire in excess of phosphoric acid, and filtering into a syrup previously made.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—That of a mild iron compound. It is a pleasant preparation to take, and is given, mostly to children, for rickets and for tubercular and anæmic conditions.

**Syrupus Ferri Phosphatis cum Quinina et Strychnina.**—A syrup containing the equivalent of 1 grain of anhydrous ferrous phosphate,  $\frac{1}{5}$  grain of quinine sulphate, and  $\frac{1}{32}$  grain of strychnine in 1 fluid drachm.

Prepared in a similar manner to the Syrup of Ferrous Phosphate, the quinine sulphate and strychnine being added to the solution of iron phosphate previous to filtering into the syrup.

It is the official representative of Easton's Syrup.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It combines the action of iron with the bitter action of quinine and the bitter and tonic actions of strychnine. The phosphate of iron plays a subsidiary part; the main action is that of strychnine. It is used as a tonic during convalescence, in so-called debility, in nervous depression, and other nervous conditions.

**Ferri Arsenas.**—‘Ferrous arsenate,  $\text{Fe}_3(\text{AsO}_4)_2, 6\text{H}_2\text{O}$ , with ferric arsenate and some iron oxide.’ It should contain the equivalent of 10 per cent. of anhydrous ferrous arsenate.

Prepared in a similar manner to phosphate of iron, substituting sodium arsenate for sodium phosphate.

*Characters.*—A greenish amorphous powder, without odour or taste. Insoluble in water or alcohol; soluble in hydrochloric acid.

It should contain no sulphates. The official quantitative test shows that it contains nearly  $12\frac{1}{2}$  per cent. of hydrous (or 10 per cent. an-

hydrous) ferrous arsenate. The test is practically useless, as it is not the amount of ferrous salt, but the quantity of arsenate, which is required.

*Dose.*— $\frac{1}{16}$  to  $\frac{1}{4}$  grain.

*Pharmacology.*—Its action is almost solely that of an arsenate (see page 200).

The following preparations contain iron wholly in the ferric condition :—

**Liquor Ferri Perchloridi Fortis.**—A liquor containing, as ferric chloride, the equivalent of 22·5 grammes of iron in 100 c.c.

Prepared by dissolving iron wire in slightly diluted hydrochloric acid and oxidising the ferrous chloride to ferric chloride by means of nitric acid. The fluid is then heated until no more nitrous fumes escape, and finally made up to the proper bulk.

*Characters.*—A dark reddish-brown liquid with a powerful astringent chalybeate taste and an acid reaction. Miscible with alcohol or water.

*Pharmacology.*—It is powerfully astringent. When applied to bleeding surfaces it coagulates the blood and constricts the tissues. If the wound is deep and full of blood, coagulation of the blood will be the only practical effect. To stop the bleeding efficiently it is necessary to cleanse the wound and apply the perchloride solution to the bleeding points. This action is known as a local hæmostatic or a styptic action. Like other astringents it produces severe smarting pain.

It is used mainly for stopping bleeding from superficial wounds, leech bites, &c., and bleeding in easily accessible cavities. It may be used in epistaxis (bleeding from the nose) when other remedies fail, the nose being packed with narrow strips of lint dipped in a diluted (1 in 3) solution. The application is somewhat painful, on account of the irritating action of the perchloride solution. It has also been used to stop bleeding from the uterus after child-birth (post-partum hæmorrhage), but as the coagula formed have in some cases been absorbed through the uterine sinuses into

the circulation, and have produced death, it is a dangerous remedy to employ. The same remark applies to the treatment of aneurism by injecting ferric chloride solution into the aneurismal sac; and, although to a less extent, to the injection of this solution into *nævi*, varicose veins, piles, &c.

**Liquor Ferri Perchloridi.**—A liquor made by diluting the strong solution of ferric chloride with three times its volume of distilled water.

*Dose.*—5 to 15 minims.

**Tinctura Ferri Perchloridi.**—Consists of strong solution of ferric chloride, 1; alcohol (90 per cent.), 1; distilled water, 2, by volume. It has, therefore, the same composition as the liquor, except that it contains a quarter its volume of alcohol in place of water.

It was thought that alcohol prevented the decomposition of the chloride into oxychloride. This is not the case; consequently this preparation is superfluous.

*Dose.*—5 to 15 minims.

*Pharmacology.*—The action of both these preparations is practically the same. Externally their action is similar to that of the strong liquor, but correspondingly weaker. When taken by the mouth, they have a strong astringent chalybeate taste. They exert an astringent action on the pharynx during the act of swallowing, and, later, an astringent action on the mucous membrane of the stomach. When repeatedly administered they are liable to cause gastric catarrh. They also act as astringents in the intestine. Their further action is that of other soluble iron compounds.

They are used sometimes, mixed with glycerin, in the treatment of chronic pharyngitis and tonsillitis, being usually painted on. They have also been employed in the treatment of other chronically inflamed mucous membranes and in skin diseases, but are not so valuable as other preparations. Taken by the mouth, they are sometimes serviceable in atonic dyspepsia and in diarrhoea, but for the latter other remedies are usually preferred.

On account of their astringent action on the stomach they cannot be used for long in the treatment of anæmia, and, unless there is decided atonic dyspepsia present, are better avoided.

**Liquor Ferri Pernitratis.**—A solution containing 3·3 grammes of iron, as ferric nitrate, in 100 c.c.

Prepared by dissolving iron in a dilute nitric acid.

*Characters.*—A light reddish-brown liquid, with an astringent chalybeate taste and an acid reaction. Miscible with alcohol or water.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Similar to that of Liquor Ferri Perchloridi. It is not much used.

**Liquor Ferri Persulphatis.**—A liquor containing 14 grammes of iron, as persulphate, in 100 c.c.

Prepared by oxidising a solution of ferrous sulphate containing an equivalent of sulphuric acid by means of nitric acid.

*Characters.*—Similar to Liquor Ferri Perchloridi Fortis, but is not so deep in colour, and has a somewhat less powerful astringent taste.

*Pharmacology.*—Its action is similar to, but weaker than, that of Liquor Ferri Perchloridi Fortis. It is only used for preparing ferric hydrate, which is employed in making the succeeding preparations.

**Liquor Ferri Acetatis.**—A liquor containing about  $1\frac{3}{4}$  grammes of iron as ferric acetate in 100 c.c.

Prepared by first making ferric hydroxide (obtained by adding solution of ferric sulphate to dilute solution of ammonia and washing the precipitate), dissolving this in glacial acetic acid and diluting with distilled water to the proper bulk, allowing any insoluble matter to subside, and pouring off the clear solution.

*Characters.*—A red liquid, with an acetous odour, and an astringent chalybeate taste. Miscible with water or alcohol.

It should contain not more than traces of sulphates, and no other impurities. Sp. gr. 1·031.



*Dose.*—5 to 15 minims.

*Pharmacology.*—Similar to, but weaker than, *Liquor Ferri Perchloridi*. It may be used for similar purposes. It is the liquor most commonly given to children with acute affections of the fauces and pharynx whether associated with a specific fever or not. Frequently, however, a solution of ferric acetate is made by ordering *Liquor Ferri Perchloridi* and *Liquor Ammonii Acetatis* in the same prescription.

The following are the so-called **scale preparations** of iron. They are not definite chemical substances, but as they are prepared in a definite manner their composition is constant. The iron in them is mainly in the ferric form except in the citrate of iron and quinine in which it exists both in the ferrous and ferric states.

They are all made in a similar way. First ferric hydroxide is obtained by pouring diluted solution of ferric sulphate into excess of diluted solution of ammonia, and washing the precipitate until free from sulphate. It is then dissolved by adding to acid potassium tartrate in the case of *Ferrum Tartaratum*, or to citric acid in the other two cases, and, after further additions (ammonia, quinine) in the latter cases, the solution is filtered through flannel and evaporated at a gentle heat to the consistence of a thin syrup. It is afterwards poured on sheet glass and allowed to dry. The scales which form are then scraped off.

The presence of ferric iron ( $\text{Fe}'''$ ) is shown by acidulating a solution with hydrochloric acid and adding solution of potassium ferrocyanide, when a deep-blue precipitate is formed; solution of potassium ferricyanide produces no change. An acidulated solution of ferrous iron ( $\text{Fe}''$ ) gives with solution of potassium ferricyanide a deep-blue precipitate, but with solution of potassium ferrocyanide a white precipitate, which, however, rapidly becomes blue owing to oxidation.

**Ferrum Tartaratum.**—A scale preparation containing not less than 21 per cent. of iron almost wholly in the ferric state.

*Characters.*—Thin transparent garnet-coloured scales with a chalybeate, somewhat sweetish taste. Miscible in all proportions with water, but only slowly with small quantities of water; insoluble in alcohol.

On incineration it should yield at least 30 per cent. of ferric oxide.

*Dose.*—5 to 10 grains.

*Pharmacology.*—That of a mild preparation of iron. It has a ferruginous but not unpleasant taste, and is well borne by the stomach. It is given mainly in anæmia. It may be administered with sodium and potassium carbonates or bicarbonates.

**Ferri et Ammonii Citras.**—A scale preparation containing about 22 per cent. of iron in the ferric state.

*Characters.*—Thin transparent deep-red scales, with a chalybeate, somewhat sweetish taste. Miscible in all proportions with water; insoluble in alcohol. Its aqueous solutions have a slight acid reaction.

On incineration it yields 31 to 32 per cent. of ferric oxide. The residue should not be alkaline to litmus, showing the absence of fixed alkali which might have been used in place of ammonia to precipitate the ferric hydroxide. It may contain traces of sulphates, but should contain no tartrates (tartaric acid might have been used in place of citric acid) or other impurity.

Tartarated iron and citrate of iron and ammonium are usually easily distinguished by the colour of the scales. With a little practice they can be identified by placing a scale upon the tip of the tongue; the citrate of iron and ammonium dissolves more quickly than the tartarated iron. But if in doubt, boiling with a solution of caustic alkali will settle the point. Both give a precipitate of ferric hydroxide, but the citrate of iron and ammonium gives off ammonia, which can easily be distinguished by the smell.

*Dose.*—5 to 10 grains.

*Pharmacology.*—Practically the same as Ferrum Tartaratum. It is used largely in the treatment of anæmia, and as an 'iron tonic' in various conditions. It may be given with sodium and potassium carbonates or bicarbonates.

**Vinum Ferri Citratis.**—A solution of 1 grain of the citrate of iron and ammonium in 1 fluid drachm of orange wine.

*Dose.*—1 to 4 fluid drachms.

*Pharmacology.*—It is a pleasant method of administering iron and ammonium citrate.

**Ferri et Quininæ Citras.**—A scale preparation containing about 19 per cent. of iron in both ferric and ferrous states, and 15 per cent. of quinine as quinine citrate.

*Characters.*—Thin greenish-yellow, somewhat deliquescent scales with a bitter chalybeate taste. Miscible in all proportions with water ; almost insoluble in alcohol.

A solution gives on addition of solution of sodium or potassium hydroxide a reddish-brown precipitate of ferric hydroxide ; on addition of solution of ammonia, a white precipitate of quinine ; on addition of solution of tannic acid, a greyish-black precipitate consisting of a mixture of iron and quinine tannates. It gives a blue precipitate both with solution of potassium ferrocyanide and with solution of potassium ferricyanide.

It should yield no fixed alkali on incineration.

*Dose.*—5 to 10 grains.

*Pharmacology.*—It has the actions of iron and of quinine (see page 291). It is used mainly as a bitter iron tonic in atonic dyspepsia, debility, anæmia, and other conditions.

## MERCURY

The official compounds and preparations of mercury may be divided into (i.) those containing the uncombined metal ; (ii.) mercurous compounds ; (iii.) mercuric compounds. They do not differ, however, essentially in pharmacological action : the chief points of difference are dependent mainly on the varying solubility of the compounds. The action of all is due to the mercury they contain, or more correctly the mercury-ions they form in solution. These are extremely poisonous to all forms of life, and, in contradistinction to most heavy metal ions, are readily absorbed. The rapidity of absorption is in all probability dependent on the fact that the precipitate of albumen produced by mercury salts is soluble in excess of albumen solution and also in excess of sodium chloride solutions.

Soluble salts of mercury are powerful disinfectants. Applied to mucous membranes or denuded surfaces, they irritate in strong solutions, but do not astringe, as they are unable to produce a localised precipitation of albumen, and diffuse too readily. Taken in large doses they produce symptoms of irritant poisoning, soon followed by collapse and other symptoms due to absorption of the compound, and death within periods varying from a few hours to several days or

even weeks. Diarrhoea, at first watery and then sanguinolent, is a common and prominent symptom. When taken repeatedly in comparatively small doses, all compounds of mercury, soluble or insoluble, produce a series of symptoms known collectively as **mercurialism**. This may be divided into two main types—(a) the common form, most usually seen after continued medicinal administration of mercurial compounds; (b) the nervous form, commonly seen in mercury miners, barometer makers, and other workers with the metal. A third type, characterised by cutaneous eruptions (erythematous, papular, so-called mercurial eczema, &c.), is relatively not uncommon. The most prominent feature of (a) the common form is an inflammation of the buccal mucous membrane (mercurial stomatitis) with profuse salivation; of (b) the nervous form, a tremor of the lips, hands, &c., which at first is most marked on movement. Individuals are differently susceptible.

The main uses of mercurial compounds are (i.) externally, as antiseptics or disinfectants; (ii.) internally, as remedies in the earlier stages of syphilis.

**Hydrargyrum**—mercury. Hg. A metallic element.

Prepared by roasting the native sulphide, condensing the volatilised metal, and purifying.

*Characters.*—A bright silver-white liquid, easily divided into spherical globules. Insoluble in water, and unacted upon by hydrochloric or sulphuric acids. It volatilises, but to a scarcely appreciable extent, at ordinary temperatures; at high temperatures it volatilises readily.

After volatilisation it should yield not more than an insignificant amount of residue.

It is used therapeutically only in the form of the following preparations, which contain mercury in a finely divided ('extinguished' or 'deadened') state.

**Hydrargyrum cum Creta**—Grey Powder. Consists of mercury, 1; prepared chalk, 2.

Prepared by triturating the mixture until it assumes a uniform grey colour.



*Characters.*—A smooth, light-bluish-grey powder, without odour and almost without taste. Insoluble in water.

Dilute hydrochloric acid dissolves the chalk, and the mercury separates as a dark powder; the filtered solution should give no reaction with the tests for mercuric compounds. After keeping some time, the particles of mercury in Grey Powder are partially oxidised, but as mercuric oxide is soluble in dilute hydrochloric acid, the filtered solution in this case would give a white or grey precipitate with solution of stannous chloride. The absence of mercuric oxide is important because it forms mercuric chloride, a powerfully poisonous substance, in the stomach.

*Dose.*—1 to 5 grains.

*Pharmacology.*—It is used mainly in the treatment of syphilis and as a purgative.

When taken by the mouth the chalk is converted into calcium chloride in the stomach, but the finely divided mercury, as far as is known, is unacted upon. It may, possibly, be oxidised to a slight extent and partially converted into mercuric chloride; but in all probability it is passed on into the intestine unchanged. Here part of it gradually enters into solution in some form and irritates the intestinal mucous membrane, finally producing purgation. After a full dose a purgative effect results on an average in 6 to 8 hours. A small portion is absorbed from the intestine and produces a beneficial influence in syphilis.

As a purgative it is used in a variety of conditions; it is frequently given to children. In the treatment of syphilis, small non-purgative doses ( $\frac{1}{4}$  to  $\frac{1}{2}$  a grain) are administered.

**Pilula Hydrargyri**—Blue Pill. A bluish pill-mass containing one-third its weight of finely divided mercury.

Mercury, 1; confection of roses,  $1\frac{1}{2}$ ; liquorice root,  $\frac{1}{2}$ .

*Dose.*—4 to 8 grains.

*Pharmacology.*—Similar in most respects to mercury with chalk. It is used largely as a purgative in 'biliousness' and in certain hepatic and other disorders.

**Unguentum Hydrargyri**—Blue Ointment. A stiff dark-blue ointment containing nearly half its weight of mercury.

Mercury, 1 ; lard, 1 ; suet,  $\frac{1}{16}$ .

*Pharmacology*.—When rubbed into the skin in small quantities (30 grains) it produces no obvious effect unless frequently applied. Then it induces irritation. It is absorbed through the skin, probably by being first oxidised and afterwards dissolved by the fatty acids of the cutaneous secretion.

It is used largely in the treatment of syphilis. A piece about the size of a hazel nut is spread on lint, or more frequently rubbed into the skin. It is applied to various parts in rotation in order to avoid the irritant action of the ointment. It is one of the quickest and most effective methods of obtaining the general action of mercury.

It is applied as a parasiticide in pediculosis pubis ; three or four applications at night combined with the necessary cleanliness being usually sufficient. It has also been applied, partly as a counter-irritant, in chronic peritonitis, especially the tuberculous peritonitis of children, and has been used in the treatment of certain chronic skin diseases. Occasionally it is given internally in syphilis in the form of a pill, but it possesses no advantages over the official pill.

**Linimentum Hydrargyri**.—A bluish ammoniated liniment containing, roughly, one-sixth its weight of mercury.

Mercury ointment, 1 oz. ; strong solution of ammonia, 160 minims ; liniment of camphor, to make 3 fl. oz.

*Pharmacology*.—It has a similar effect to mercury ointment. The camphor liniment and solution of ammonia make it more stimulating.

It may be used in the treatment of syphilis and in chronic inflammatory conditions of joints and other structures.

**Unguentum Hydrargyri Compositum.**—A greyish-blue ointment containing one-fifth its weight of mercury and nearly one-eighth its weight of camphor.

Mercury ointment, 10; yellow beeswax, 6; olive oil, 6; camphor, 3.

It is a slightly modified Scott's Dressing.

*Pharmacology.*—The camphor aids the stimulant action of the mercury on the skin. This ointment is used mainly in subacute and chronic synovitis. It is applied on strips of lint which are wrapped round the joint and left in position for a week or more, the joint being kept at rest by means of a splint.

**Emplastrum Hydrargyri.**—A plaster containing nearly one-third its weight of mercury.

Mercury, 3 oz.; lead plaster, 6 oz. The mercury is first 'extinguished' by triturating it with olive oil (56 gr.) and sublimed sulphur (8 gr.), and is then added to the melted lead plaster.

*Pharmacology.*—Less powerful, but otherwise similar to mercury ointment. Mercury is absorbed from it through the skin. It may therefore be used in the general treatment of syphilis as well as in local affections.

**Emplastrum Ammoniaci cum Hydrargyro.**—A plaster containing nearly one-fifth its weight of mercury and four-fifths its weight of ammoniacum.

Mercury 3 oz. is 'extinguished' as in mercury plaster, and then added to Ammoniacum 12 oz., purified by boiling with water in a special manner (see B.P.).

*Pharmacology.*—Similar to mercury plaster. Ammoniacum also stimulates the skin (see pages 514, 525).

**Hydrargyri Oxidum Flavum**—yellow mercuric oxide.  $\text{HgO}$ .

Prepared by adding a solution of sodium hydroxide to a solution of mercuric chloride, washing, and carefully drying.

*Characters.*—A yellow amorphous powder, without taste or odour. Insoluble in water or alcohol, readily soluble in hydrochloric acid. When gently heated it undergoes a

physical change and assumes a red colour, but regains its original colour when cooled.

It decomposes at red heat into oxygen and vapour of mercury. It should yield 92 to 92·5 per cent. of metallic mercury.

*Pharmacology.*—Rubbed into the skin in the form of a strong ointment or applied to mucous membranes it has a fairly powerful irritant effect. Its action is similar to but more powerful than that of finely divided mercury. Taken by the mouth, it is converted into mercuric chloride in the stomach and acts as such.

It is used chiefly in the form of the official ointment. A stronger ointment may be used in place of the ointment of the red oxide in diseases in which this is beneficial.

**Unguentum Hydrargyri Oxidi Flavi.**—Consists of yellow mercuric oxide 1, yellow soft paraffin 49.

*Pharmacology.*—Being a dilute ointment its action is comparatively mild. It is used largely in diseases of the eye. It is for this reason that it is made with soft paraffin. It is a valuable preparation for ‘sore lids,’ corneal opacities, and other corneal and conjunctival diseases, as well as for various syphilitic diseases of the eye. It is also of use in the treatment of chronic and syphilitic skin diseases.

The yellow oxide is the main active ingredient of **Lotio Hydrargyri Flava**. (See page 184.)

**Hydrargyri Oxidum Rubrum**—red mercuric oxide.  
 $\text{HgO}$ .

Prepared by heating an intimate mixture of mercuric nitrate and mercury.

*Characters.*—A heavy, orange-red, crystalline powder, or crystalline scales. Insoluble in water or alcohol; soluble in hydrochloric acid. It darkens on heating, gradually becoming a dark violet, but regains its original colour on cooling.

It should contain no mercuric nitrate.

The difference in colour of the two mercuric oxides is due to the difference in their physical condition, the red oxide being much coarser than the yellow oxide.



*Pharmacology.*—The same as the yellow oxide. It is used almost solely in the form of the official ointment.

**Unguentum Hydrargyri Oxidi Rubri**—red precipitate ointment. Consists of red mercuric oxide 1, yellow paraffin ointment 9.

*Pharmacology.*—This ointment is five times stronger than the ointment of the yellow oxide. It is consequently much more powerful. The reason for the different strengths of the two ointments is the different uses to which they are put. The ointment of the red oxide is employed in enlargements of the lymphatic glands (and formerly of the thyroid) and is applied daily until distinct tenderness appears. It is also applied to syphilitic conditions, chronic ringworm, and occasionally other chronic skin diseases.

The two mercurial lotions owe their activity mainly to oxides of mercury and are therefore considered here. *Lotio Hydrargyri Flava* contains the yellow mercuric oxide, *Lotio Hydrargyri Nigra* the black mercurous oxide. The lotions are prepared by adding mercuric chloride in the one case, and mercurous chloride in the other, to lime-water. As an excess of lime-water is used in both cases, the lotions contain a small quantity of calcium hydroxide in solution and also a small amount of calcium chloride produced by the interaction.

**Lotio Hydrargyri Flava**—yellow wash. Contains rather more than  $1\frac{1}{2}$  grains of yellow mercuric oxide and a little calcium hydroxide and calcium chloride in 1 fluid ounce.

Prepared by adding 20 gr. of mercuric chloride to 10 fl. oz. of solution of lime.



*Pharmacology.*—Its action is that of mercuric oxide aided by the mild astringent action of the calcium hydroxide and calcium chloride in solution.

It is applied to syphilitic ulcers and other syphilitic conditions (condylomata, &c.), but is less frequently used than black mercurial lotion.

**Lotio Hydrargyri Nigra**—black wash. Contains nearly three grains of mercurous oxide in 1 fluid ounce. A little calcium hydroxide and calcium chloride are present in solution, and glycerin and mucilage of tragacanth are employed as suspending agents.

Mercurous chloride, 30 gr. ; glycerin,  $\frac{1}{2}$  fl. oz. ; mucilage of tragacanth,  $1\frac{1}{4}$  fl. oz. ; solution of lime, to make 10 fl. oz.



*Pharmacology*.—Similar to, but somewhat milder than, yellow wash. It is used in the treatment of syphilitic ulcers and other external syphilitic affections.

**Hydrargyri Perchloridum**—mercuric chloride. Corrosive sublimate.  $\text{HgCl}_2$ .

Prepared by recrystallising the sublimate obtained by heating a mixture of mercuric sulphate, sodium chloride, and a little black oxide of manganese. The last-named substance is added to prevent the formation of calomel.

*Characters*.—Heavy colourless crystalline masses, without odour but with a very acrid metallic taste. Soluble in 18 parts of water, in 4 parts of alcohol, in 5 parts of ether, and in 2 parts of glycerin. Its aqueous solutions have an acid reaction. It sublimes unchanged.

It should yield not more than a trace of fixed residue.

*Dose*.— $\frac{1}{32}$  to  $\frac{1}{16}$  grain.

*Pharmacology*.—It possesses the typical action of mercurions. It is powerfully poisonous to all forms of living cells, and is therefore a powerful disinfectant. Aqueous solutions of 1 in 500 kill all micro-organisms and most spores, and in much greater dilution (1 in 5,000) it inhibits the development of spores (antiseptic action). The presence of albuminous matter diminishes its disinfectant and antiseptic actions considerably. Applied in strong solution to mucous membranes and denuded surfaces it is irritant and, since it may cause death of cells, even caustic. It is readily absorbed from wounds, and death has frequently resulted from irrigating large wounds or cavities with large amounts of dilute (1 in 2,000) solutions.

Taken by the mouth, it has an acrid metallic taste. In small doses it has no obvious effect on the stomach or intestine, but if repeatedly given it often causes loss of appetite and interference with digestion. It is fairly rapidly absorbed, probably as a double chloride, but in ordinary doses it exerts no important action on healthy tissues unless repeatedly administered for some time; then symptoms of mercurialism may develop. Syphilitic tissues are much more readily affected. To some extent it is stored up in the tissues, but the greater part administered is quickly excreted by the kidneys and the lower parts of the intestines.

It is used largely as an antiseptic and disinfectant, especially in the 'antiseptic treatment of wounds.' It cannot, however, be employed for disinfecting metallic instruments. It is also useful in the treatment of some parasitic skin diseases. It is administered internally for syphilis either by the mouth or by subcutaneous or intramuscular injection. The latter method produces transient pain and tenderness.

**Liquor Hydrargyri Perchloridi.**—An aqueous solution containing  $\frac{1}{2}$  grain of mercuric chloride in 1 fluid ounce.

Mercuric chloride, 10 gr. ; distilled water, 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is a convenient solution of mercuric chloride and the preparation generally used when this compound is administered internally.

**Hydrargyri Subchloridum** — mercurous chloride.  
Calomel.  $\text{Hg}_2\text{Cl}_2$ .

Prepared by heating a mixture of mercurous sulphate (or mercuric sulphate and mercury) and sodium chloride, washing and drying the sublimate.

As calomel vapour dissociates into vapour of mercuric chloride and mercury, these substances may contaminate the product. It is therefore necessary to wash it with water or ether to free it from the more poisonous perchloride.

*Characters.*—A heavy white or yellowish-white powder, without odour and almost without taste. Insoluble in water, alcohol, or ether. It completely volatilises below a red heat.

It is immediately decomposed by hydrocyanic acid into a mercuric salt, which remains in solution, and mercury, which forms a black precipitate.

It should contain no mercuric chloride (which, if present, may be obtained as a white residue after washing the calomel with ether, filtering, and allowing the ether to evaporate) and no mercuric ammonium chloride (which gives the odour of ammonia when warmed with caustic potash or soda solution); and it should contain not more than a trace of fixed residue. It should yield 84.4 to 84.9 per cent. of metallic mercury. The theoretical yield is 84.96 per cent.

*Dose.*— $\frac{1}{2}$  to 5 grains.

*Pharmacology.*—Applied externally, calomel produces no important effect on the unbroken skin, but if rubbed in, especially in the form of an ointment, it causes mild irritation and is absorbed in some form. Its action is similar to that of the oxides of mercury and of ammoniated mercury, but is milder. When taken by the mouth, it is without distinct taste, and usually produces no action on the stomach; in some persons, however, it causes sickness. After passing into the intestine it induces mild irritation of the intestinal tract and causes purgation. The motion is watery in character, and in children often greenish owing to the presence of biliverdin. After a dose of 2 or 3 grains taken in the morning, purgation generally follows in four to five hours, but it may be later. Griping sometimes occurs, usually not, but there is often slight anal irritation and not infrequently some abdominal soreness after the purgation. Calomel also acts as a so-called intestinal antiseptic. Most of the calomel taken is excreted in the fæces; a small portion is absorbed, probably as a double mercuric compound. If given in doses insufficient to cause purgation, most is absorbed. The chief effect of this in non-syphilitic individuals is mild stimulation of the kidneys and consequent diuresis. This does not occur, however, in all cases; it is generally most marked in heart disease with dropsy. Repeated administration of calomel produces mercurialism.

It is used externally in the form of the official ointment, and as the powder itself. The latter may be sprinkled on syphilitic ulcers; and it has been applied to the eye in external



diseases of a chronic nature. It is given by the mouth as a purgative, and, in small doses, as a remedy for syphilis. Its diuretic action in heart disease is of questionable value. In syphilis it is sometimes given hypodermically.

**Unguentum Hydrargyri Subchloridi.**—Consists of calomel 1, benzoated lard 9.

*Pharmacology.*—It is mildly irritating. It is applied to syphilitic eruptions and to chronic eczema and similar diseases.

**Pilula Hydrargyri Subchloridi Composita**—Plummer's Pill. Contains calomel 1, sulphurated antimony 1, guaiacum resin 2, and a little castor oil (nearly  $\frac{1}{2}$ ).

It is made into a mass with alcohol.

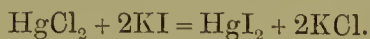
*Dose.*—4 to 8 grains.

*Pharmacology.*—Its action is that of its constituents. In pharmacopœial doses it is only mildly purgative. It is often useful in chronic skin diseases, especially those of a gouty or syphilitic nature. The castor oil is sometimes left out of the pill, as it is said to hinder the disintegration of the other constituents.

Calomel is used in preparing **Lotio Hydrargyri Nigra**. (See page 185.)

### **Hydrargyri Iodidum Rubrum**— $\text{HgI}_2$ .

Prepared by the interaction of molecular quantities of mercuric chloride and potassium iodide in solution. The precipitate is washed and carefully dried.



If a larger amount of potassium iodide is used, a double salt,  $\text{K}_2\text{HgI}_4$ , is formed which is soluble in water.

*Characters.*—A scarlet-red crystalline powder, without odour and almost without taste. Insoluble in water; slightly soluble in alcohol and fixed oils, more freely in ether; readily soluble in solution of potassium iodide and a few other salts. It becomes yellow when warmed, and volatilises under redness.

It should contain no mercurous iodide, and not more than a trace of fixed matter. It should yield 43·5 to 44 per cent. of metallic mercury. The theoretical yield is 44·1 per cent.

*Dose.*— $\frac{1}{32}$  to  $\frac{1}{16}$  grain.

*Pharmacology.*—Its action closely resembles that of mercuric chloride. It is insoluble in water, but is slightly soluble in dilute hydrochloric acid, and in the stomach it is converted, partially at least, into the perchloride. Externally applied, it has an irritant action. Taken internally, its action is practically the same as that of the perchloride. Its uses are the same. The iodide-ion is not present in sufficient amount to exert any useful action.

**Unguentum Hydrargyri Iodidi Rubri.**—Consists of mercuric iodide 1, benzoated lard 24.

*Pharmacology.*—If rubbed well into the skin it produces decided irritation, and may even blister. It has been used in the treatment of goitre and inveterate ringworm. Diluted three to four times, it is sometimes useful in certain chronic skin diseases, especially those of a parasitic nature.

**Liquor Arsenii et Hydrargyri Iodidi.**—See page 201.

**Hydrargyrum Ammoniatum**—mercuric-ammonium chloride. Infusible white precipitate.  $\text{NH}_2\text{HgCl}$ .

Prepared by adding a solution of mercuric chloride to a solution of ammonia, collecting the precipitate, washing until free from chlorides, and drying at a temperature not exceeding  $100^\circ\text{C}$ .

*Characters.*—A white powder or white lumps, without taste or odour. Insoluble in water (it is slowly converted into a basic salt by the action of water), in alcohol, or in ether. It volatilises, without fusing, below a red heat. When heated with solution of potassium hydroxide it evolves ammonia, and is finally converted into the yellow oxide.

Boiled with a solution of stannous chloride it becomes grey, and finally yields globules of metallic mercury. It should contain only an insignificant amount of fixed residue, and should yield 78 to 79 per cent. of metallic mercury. The theoretical yield is 79·54 per cent.

*Pharmacology*.—Applied externally in the form of a strong ointment it is irritant. When taken by the mouth in considerable doses it is poisonous, being slowly converted into mercuric chloride (and ammonium chloride) in the stomach. It is used almost solely as an ointment.

**Unguentum Hydrargyri Ammoniati**.—Consists of ammoniated mercury 1, white paraffin ointment 9.

*Pharmacology*.—It produces an effect similar to, but less powerful than, that of the ointment of the red oxide. It is used to apply to ringworm. For other purposes it is somewhat too irritating. When diluted, however, it is a useful application for certain parasitic and chronic skin diseases (psoriasis, chronic eczematous eruptions, and syphilitic skin diseases).

**Hydrargyri Oleas**—precipitated mercuric oleate, containing a little mercuric palmitate.

Prepared by the interaction of boiling solutions of mercuric chloride and hard soap (mainly sodium oleate) to which sufficient oleic acid has been added to counteract the alkalinity and thus prevent the formation of a basic compound. The precipitate is washed until free from chlorides, and carefully dried.

*Characters*.—A light greyish-yellow unctuous substance with a somewhat saponaceous odour. It is liable to darken by keeping, owing to reduction.

*Pharmacology*.—Its action is similar to that of the ointment of the red oxide. It is used mainly in a diluted form.

**Unguentum Hydrargyri Oleatis**.—Consists of mercuric oleate 1, benzoated lard 3.

*Pharmacology*.—Similar to, but more irritating than, mercury ointment. It may be used in the same class of cases as the ointment of ammoniated mercury.

**Liquor Hydrargyri Nitratis Acidus**.—A colourless strongly acid liquid containing over half its weight of mercuric nitrate and about 20 per cent. by weight of hydrogen nitrate,  $\text{HNO}_3$ .

Prepared by dissolving mercury 4 oz. in nitric acid 5 fl. oz. diluted with distilled water  $1\frac{1}{2}$  fl. oz., without the aid of heat, and afterwards boiling gently for fifteen minutes; cool; preserve in a stoppered bottle away from the light.

*Pharmacology.*—A powerfully corrosive liquid. It may be used to destroy syphilitic ulcers, warts, condylomata, &c., but must be used with care. It is generally diluted with five to ten times its volume of water before being employed for this purpose.

**Unguentum Hydrargyri Nitratis**—citrine ointment. A light greenish-yellow ointment containing about 10 per cent. of mercuric nitrate and some free nitric acid.

Prepared by dissolving mercury 1 oz. in nitric acid 3 fl. oz., without the aid of heat, adding this gradually to a mixture of lard 4 oz. and olive oil 7 oz. heated to  $143^{\circ}\text{C}$ ., stirring all the time to promote disengagement of fumes; stir until cold.

The firmness of the ointment as compared with the lard and olive oil from which it is made is due to the conversion of the olein into an isomeric substance, elaidin. This substance has no reducing action on the mercuric nitrate present in the ointment.

*Pharmacology.*—It has a rather powerful irritant action, and is rarely used undiluted.

**Unguentum Hydrargyri Nitratis Dilutum.**—Consists of mercuric nitrate ointment 1, yellow soft paraffin 4.

*Pharmacology.*—It is somewhat irritant when rubbed into the skin, but it is rarely applied in this way. Whitlows are sometimes dressed with it, and, diluted, it is also used in some chronic skin affections.



## COMPOUNDS OF ANTIMONIUM AND ARSENIUM

THE metals antimony and arsenic bridge the gap between the heavy metals and the non-metallic elements. Chemically they are allied to bismuth on the one hand and to phosphorus on the other, antimony being more closely allied to the former and arsenic to the latter. Pharmacologically a similar relationship can be traced, although this is not obvious.

Both antimony and arsenic have only weak basic properties, and consequently may form part of an acidulous radical. This is especially the case with arsenic; in most medicinal preparations it exists, wholly or partly, as arsenite or arsenate.

## ANTIMONIUM

Four compounds containing antimony are official. Owing to the complex ionisation of the only one soluble in water, their pharmacology is most conveniently described individually.

**Antimonium Tartaratum**—tartar emetic.

$K(SbO)C_4H_4O_6, \frac{1}{2}H_2O$ , or  $KSbC_4H_4O_7, \frac{1}{2}H_2O$ .

Prepared by making acid potassium tartrate and slight excess of antimony oxide into a paste with water, allowing to stand for 24 hours or longer until combination has been effected, extracting with boiling water, filtering, and crystallising.

*Characters.*—Colourless transparent crystals showing triangular facets, with an unpleasant sweetish metallic taste, but without odour. Soluble in 18 parts of water; insoluble in alcohol.

Its aqueous solutions are precipitated by tannic acid, gallic acid, and by caustic alkalies and alkaline carbonates. It should contain no acid potassium tartrate or other impurity.

*Dose.*—As a diaphoretic,  $\frac{1}{24}$  to  $\frac{1}{8}$  grain ; as an emetic, 1 to 2 grains.

*Pharmacology.*—It is an irritant, but this action develops slowly, mainly because it is absorbed with difficulty by cells. If rubbed into the skin in the form of an ointment it produces after a time redness, which may finally terminate in a pustular eruption. The mouths of the sweat glands are affected most severely owing to the skin being least resistant at these points. When taken by the mouth, it has a somewhat acrid taste, and in doses of 1 grain or more produces vomiting in ten to thirty minutes. This is accompanied by severe nausea and other concomitant symptoms of vomiting, and the nausea and depression usually remain for some time after the vomiting has ceased. The vomiting is due mainly to a local irritant action on the gastric mucous membrane. If taken in smaller doses repeatedly it is absorbed, and increases and renders less tenacious the bronchial secretion and produces slight sweating. It also depresses the heart.

It is much less frequently used than formerly. It is, however, useful in the early stages of bronchitis and in certain acute and chronic skin diseases, and is sometimes given in febrile conditions accompanied by a ‘full bounding pulse.’ It is rarely administered for its emetic action.

**Vinum Antimoniale**—sherry, containing 2 grains of tartarated antimony in 1 fluid ounce.

Tartarated antimony, 40 gr. ; boiling distilled water, 1 fl. oz. sherry, to make 20 fl. oz.

*Dose.*—10 to 30 minims ; as an emetic, 2 to 4 fluid drachms.

*Pharmacology.*—It is a convenient solution of tartar emetic for purposes of administration.

**Antimonii Oxidum**—antimonious oxide.  $\text{Sb}_2\text{O}_3$ .

Prepared by pouring a solution of antimony trichloride into water, boiling the precipitated antimony oxychloride with solution of sodium carbonate, washing and carefully drying the precipitate.

*Characters.*—A nearly white powder, without odour and almost without taste. Insoluble in water or alcohol; soluble in hydrochloric acid and some organic acids, and in glycerin.

It should contain only traces of chlorides and sulphates, and no other impurity; and should be completely soluble when boiled with an excess of an acid potassium tartrate solution.

*Dose.*—1 to 2 grains.

*Pharmacology.*—Its action in pharmacopœial doses is similar to that of small doses of tartar emetic. It has no irritant action and no distinctive taste. In the stomach it is converted into chloride and oxychloride.

It is but little used. It may be employed in the same class of cases as tartar emetic.

**Pulvis Antimonialis.**—Consists of antimonious oxide 1, calcium phosphate 2.

*Dose.*—3 to 6 grains.

*Pharmacology.*—The same as that of antimonious oxide; the calcium phosphate is merely a diluent. The powder has been given in fevers, but is rarely used now.

It is the official representative of James's Fever Powders, which were formerly much used.

**Antimonium Sulphuratum.**—‘A mixture containing antimony sulphides and oxides,  $\text{Sb}_2\text{S}_5$ ,  $\text{Sb}_2\text{O}_5$ ,  $\text{Sb}_2\text{S}_3$ ,  $\text{Sb}_4\text{O}_6$ , and sulphur.’

Prepared by boiling together antimonious sulphide 2, sublimed sulphur 2, caustic soda 1, in distilled water for 2 hours, straining, and gradually adding to the solution, while warm, slight excess of dilute sulphuric acid; wash the precipitate until free from sulphate, and dry below  $100^\circ\text{C}$ .

The official instructions should be followed minutely, as any deviation is liable to lead to variability in the composition of the product.

*Characters.*—A dull-red powder, without odour, and with a very slight taste. Insoluble in water. It dissolves in solutions of caustic alkalies, forming antimonates, thio-antimonates, &c., and in hot hydrochloric acid with the evolution of sulphuretted hydrogen and the separation of sulphur.

It should contain only the slightest traces of arsenic. Three grammes should yield 2 grammes of antimonie oxide.

*Dose.*—1 to 2 grains.

*Pharmacology.*—Practically the same as antimonious oxide. It is rarely used therapeutically, except in the form of the compound calomel pill.

**Pilula Hydrargyri Subchloridi Composita.**—See page 188.

**Antimonium Nigrum Purificatum.**—Native antimonious sulphide,  $\text{Sb}_2\text{S}_3$ , purified and reduced to fine powder.

Siliceous matter is removed by fusion; arsenic, if present, by digesting for several days in half its weight of solution of ammonia, washing, and drying.

*Characters.*—A greyish-black crystalline powder, insoluble in water.

On boiling with excess of hydrochloric acid, it evolves sulphuretted hydrogen, and should form an almost clear solution of antimony trichloride. It should not contain more than traces of arsenic.

It is used only for preparing other compounds of antimony.

## ARSENICUM

The official compounds of arsenium are extremely poisonous. They are more readily absorbed than the compounds of antimony, and consequently exert a more marked general effect. Applied locally they slowly kill tissues, and when taken by the mouth in sufficient doses produce symptoms of irritant poisoning. In most cases the symptoms do not appear for half an hour or more; then there is a feeling of constriction and burning in the throat and œsophagus, quickly followed by pain and tenderness in the epigastrium and vomiting. Later, diarrhœa appears, and the stools gradually assume a characteristic appearance, closely resembling rice water. The abdominal pain and tenderness increase, symptoms of collapse develop, and the patient dies usually in a comatose condition. Sometimes after large doses collapse occurs, and the patient dies before the gastro-enteric symptoms have had time to develop.



After the continued use of small doses of arsenical compounds, a series of symptoms, known collectively as **chronic arsenical poisoning**, are produced in many people. These vary in different individuals, and to some extent according to the path by which the compound reaches the system. Most commonly there is inflammation of various mucous membranes (eyes, nose, &c.), gastric uneasiness and diarrhœa, and, later, usually inflammation of the peripheral nerves (peripheral neuritis) and cutaneous eruptions (erythematous, papular, vesicular, pustular, &c., keratosis, pigmentations). One or more of these groups of symptoms may be predominant or may occur alone. In the case of arsenical workers the symptoms are confined mainly to catarrhal affections of the throat and upper air passages.

While some individuals suffer from chronic arsenical poisoning after taking arsenic in one or other form, other individuals appear to acquire a tolerance to it. The most notable instance is that of the peasants of Styria, who, after long training, are able to take poisonous doses with impunity; but a similar tolerance has also been noticed among workers in arsenical ores and others.

The mode of action of arsenic on the tissues is not well understood. It has no obvious action on dead tissue, but it gradually kills living tissue, and often mummifies it. It is a mild disinfectant. Its most important actions in medicinal doses are on the blood in disease, the skin, and nutrition generally. It often improves nutrition, and is frequently given to horses for this purpose. It has no distinct action on the blood in health, but in some diseases, especially those associated with lymphocytosis, it brings back the condition of the blood towards health. Experimentally, it has been found to affect the bone marrow, converting the yellow fatty variety into something akin to red marrow. Its influence on the skin is obvious from the pigmentation and eruptions it causes, and it has been demonstrated experimentally. Arsenic has been found in the epidermal scales and the hair after its medicinal administration.

After the administration of moderate doses, and especially

after prolonged use, arsenic produces fatty degeneration of tissues resembling, but less marked than, that produced by phosphorus. Changes in the bones similar to those obtained from phosphorus have also been described, but these have not been found by recent investigators.

Arsenic is readily absorbed, and is excreted in the urine, sweat, and other excretions.

**Acidum Arseniosum**—arsenious anhydride. Arsenious oxide.  $\text{As}_2\text{O}_3$ . Commonly called arsenic.

Prepared by roasting arsenical pyrites; also obtained as a by-product in the extraction of tin &c. from arsenical ores. It is purified by re-sublimation.

*Characters.*—Stratified or white porcelain-like masses or a heavy white powder, without odour and almost without taste. Soluble in 100 parts of water (see below) and in 5 parts of glycerin; slightly soluble in alcohol. It is more soluble in dilute hydrochloric or sulphuric acids and in dilute alkalis than in water. Its aqueous solution is faintly acid.

When slowly heated in a tube it sublimes, and settles on a cooler part of the tube as minute transparent octahedral crystals. It should contain no arsenious sulphide.

The stratified appearance of lump arsenic is due to the fact that arsenic exists in two (it can be obtained in three) allotropic forms. When prepared in the ordinary way the vitreous variety is first formed, but under the influence of the aqueous vapour in the air it is gradually converted into the opaque crystalline variety. The two varieties differ considerably in their solubility in water and other substances. The amorphous variety is the more soluble, but after a short time it is gradually converted into the less soluble variety. The following abridged table from 'Corney's Dictionary of Chemical Solubilities' will give the best idea of the solubility of the two forms. The numbers refer to parts soluble in 100 parts of water at ordinary temperatures:

	Crystalline form	Amorphous form
1 hour . . .	0.023	1.589
3 hours . . .	0.088	2.356
6 hours . . .	0.353	3.666
24 hours . . .	0.956	3.306
2 days . . .	1.627	2.629
1 week . . .	1.673	1.763

When dissolved in water, arsenious anhydride becomes arsenious acid (or, rather, forms a number of hydrates,  $\text{H}_6\text{As}_2\text{O}_6$ ,  $\text{H}_4\text{As}_2\text{O}_5$ ,  $\text{H}_4\text{AsO}_4$ ), but the solution has very weak acid properties.

*Dose.*— $\frac{1}{60}$  to  $\frac{1}{15}$  grain.

*Pharmacology.*—This has been described above.

It has been used, diluted with charcoal, flour, antimony sulphide, &c., as a local application to cancer and other diseases, but it is a painful remedy, and is liable to be absorbed, so that its use has been abandoned. It is still employed, combined with morphine, cocaine, &c., by dentists to kill the nerve previous to filling a tooth.

It is given internally in a large number of diseases, especially chronic skin diseases (lichen, psoriasis, pemphigus, &c.), and certain diseases associated with marked changes in the blood (pernicious anæmia, leukæmia, &c.), or in lymphatic glands (lymphadenoma). It is not of much use alone in simple anæmia.

It is frequently employed in some nervous diseases (chorea, neuralgia, &c.), in cardiac weakness, asthma, chronic gastric catarrh, chronic rheumatism, gout, and numerous other diseases. Next to quinine, it is one of the best remedies for the treatment of malaria, but it is much inferior to quinine, and is not largely employed.

Arsenic should usually be given after meals.

**Liquor Arsenicalis**—Fowler's solution. A liquor containing the equivalent of 1 gramme of arsenious anhydride in 100 c.c. Practically a 1 per cent. solution. It is perfumed and coloured with compound tincture of lavender.

Arsenious anhydride, 1 g.; potassium carbonate, 1 g.; compound tincture of lavender,  $3\frac{1}{2}$  c.c.; distilled water, to make 100 c.c.

The potassium carbonate aids the solution of the arsenic. Only a small amount of potassium arsenite is formed unless prolonged boiling is employed, which the Pharmacopœia does not recommend.

*Characters.*—A reddish liquid with a lavender odour. It has an alkaline reaction.

*Dose.*—2 to 8 minims.

*Pharmacology.*—Its action and uses are those of arsenious anhydride. It is the preparation commonly used for administering this substance. It should not be

prescribed with acid solutions or with substances incompatible with alkalis.

**Liquor Arsenici Hydrochloricus.**—An acid arsenical solution of the same strength as Liquor Arsenicalis.

Arsenious anhydride, 1 g.; hydrochloric acid,  $1\frac{1}{4}$  c.c.; distilled water, to make 100 c.c.

The acid aids the solution of the arsenic.

*Characters.*—A colourless liquid without distinctive taste. It has an acid reaction.

*Dose.*—2 to 8 minims.

*Pharmacology.*—The same as Liquor Arsenicalis. It is prescribed in place of Liquor Arsenicalis whenever it is necessary to order preparations or substances (acids, alkaloidal preparations) incompatible with this.

**Sodii Arsenas.**—Anhydrous di-sodium hydrogen arsenate.  $\text{Na}_2\text{HAsO}_4$ .

Prepared by fusing arsenious anhydride with sodium nitrate and sodium carbonate, extracting the fused mass with water, and crystallising. The water of crystallisation is then driven off by heating to  $150^\circ\text{C}$ .

The anhydrous salt is official because the crystalline salt varies somewhat in composition. When freshly prepared it is  $\text{Na}_2\text{HAsO}_4 \cdot 12\text{H}_2\text{O}$ , but it effloresces and becomes  $\text{Na}_2\text{HAsO}_4 \cdot 7\text{H}_2\text{O}$ .

*Characters.*—A white powder with a slight saline taste. Soluble in 5 parts of water; insoluble in alcohol. Its aqueous solution has an alkaline reaction.

It should contain no impurity.

*Dose.*— $\frac{1}{40}$  to  $\frac{1}{10}$  grain.

*Pharmacology.*—Its action is similar to that of arsenious anhydride, but weaker. This is due to the facts that it contains less combined arsenium and that, apart from this, arsenates are weaker than arsenites. It is used for the same purposes as arsenious anhydride, and is generally administered as the official liquor.

**Liquor Sodii Arsenatis.**—A 1 per cent. solution of anhydrous sodium arsenate in distilled water. It contains only about half the quantity of arsenium present in Liquor Arsenicalis.



*Dose.*—2 to 8 minims.

*Pharmacology.*—Its action is similar to, but weaker than, that of *Liquor Arsenicalis*. It is used for the same purposes.

**Ferri Arsenas.**—‘Ferrous arsenate,  $\text{Fe}_3(\text{AsO}_4)_2 \cdot 6\text{H}_2\text{O}$ , with ferric arsenate and some iron oxide.’ Ferrous arsenate must be present to the extent of  $12\frac{1}{2}$  per cent. of the hydrous, or 10 per cent. of the anhydrous, salt.

Prepared by adding solution of sodium arsenate to slight excess of solution of ferrous sulphate, and subsequently sufficient solution of sodium bicarbonate to neutralise the sulphuric acid formed by the interaction; wash the precipitate until free from sulphates, press to remove excess of water, and dry at a temperature not exceeding  $38^\circ\text{C}$ .

The ferrous arsenate first precipitated is white, but it rapidly becomes greenish from oxidation. It is necessary to neutralise the sulphuric acid produced in the reaction (owing to sodium arsenate being an acid and ferrous arsenate a normal salt), as arsenate of iron is soluble in dilute acids.

*Characters.*—A greenish amorphous powder, without odour or taste. Insoluble in water, but readily dissolved by hydrochloric acid.

It should contain no sulphates. The only quantitative test given in the *Pharmacopœia* shows that the preparation contains 10 per cent. of anhydrous ferrous arsenate. This is of subsidiary interest. The point of importance is the quantity of arsenate present, whether ferrous or ferric.

*Dose.*— $\frac{1}{16}$  to  $\frac{1}{4}$  grain.

*Pharmacology.*—Iron arsenate is soluble in dilute acids, hence in ordinary doses it is probably wholly dissolved in the stomach. Its action is that of its component radicals, but is mainly that of an arsenate. The effect of the iron, even in full doses, is comparatively insignificant. It has, however, the same action as that of any other iron compound administered in the same (equimolecular) dose. The amount of arsenate in hydrous ferrous arsenate is about half the weight of the compound; in the official iron arsenate it is less. Arsenates are also less powerful than arsenites. Hence the dose of *Ferri Arsenas*, although considerably more than that of *Acidum Arseniosum*, is comparable with it.

It has been used in anæmia and other pathological conditions of the blood in which iron and arsenical compounds are believed to be beneficial. There is, however, no special virtue in this compound, and it is often better to administer iron and arsenical compounds separately. It has been employed in anæmia, in chronic rheumatism, and in certain chronic skin diseases.

**Arsenii Iodidum.**—Arsenious iodide,  $\text{AsI}_3$ .

Prepared by heating a mixture of equivalent quantities of metallic arsenic and iodine.

*Characters.*—Orange or orange-red crystals or crystalline masses, with an acid taste and a faint iodine odour. Soluble in 12 parts of water, and in 50 parts of alcohol. Its aqueous solution is markedly acid (the Pharmacopœia says neutral).

It is not a very stable compound. Exposed to air and light it gradually gives off iodine vapour at ordinary temperatures; to a larger extent if heated. It may be entirely volatilised by heat.

*Dose.*— $\frac{1}{20}$  to  $\frac{1}{5}$  grain.

*Pharmacology.*—It has a similar action to arsenious acid. (In solution it gradually decomposes into hydriodic and arsenious acids.) The quantity of iodide, even in a full dose, is too small to exert much effect. It is used almost solely in the form of the following liquor.

**Liquor Arsenii et Hydrargyri Iodidi.**—Donovan's solution. A liquor prepared by dissolving 1 gramme of arsenious iodide and 1 gramme of mercuric iodide in 100 c.c. of distilled water.

It is a complex mixture, the constitution of which is unknown. It probably contains free hydriodic acid, arsenious acid, a complex acid containing mercury and iodine (mercuro-iodic acid), and the original substances.

*Characters.*—A clear pale-yellow liquid with a slightly acid, unpleasant metallic taste.

*Dose.*—5 to 20 minims.

*Pharmacology.*—Its action is that of arsenite and mercury ions. It is used mainly in the treatment of chronic skin diseases.

## SYNTHETIC ORGANIC SUBSTANCES

IN this group will be included nearly all the official organic substances which have been synthesised, although they may not necessarily be prepared, commercially, in this way. For convenience, some of the pure organic substances, which have been synthesised, derived from animals and plants, are considered later in connection with the drugs from which they are derived, because the pharmacological action of the crude drug and pure principle are similar, and, in most cases, identical. A few organic acids have been already described (page 66, *et seq.*).

The substances of the aliphatic group (the open-chain hydrocarbons and their derivatives) will be taken first.

### PARAFFINS

Three paraffins, or rather mixtures of paraffins, are official, and are termed, respectively, liquid paraffin, soft paraffin, and hard paraffin. Chemically, they all possess similar properties; they are very stable substances, cannot be saponified, and are insoluble in aqueous media.

Pharmacologically, the lower boiling liquid paraffins produce an irritant effect on the skin when applied for some time, but the official paraffins have an almost pure protective effect. The latter are not absorbed to any appreciable extent when applied externally or when taken by the mouth, and, consequently, they exert no general action on the body. (A few of the lowest boiling paraffins will produce anæsthesia when inhaled.)

The paraffins are derived from crude petroleum or shale by distillation. Nearly all the paraffins (except hard paraffin), used in this country, are

derived from American petroleum, which consists almost solely of normal paraffins ( $C_nH_{2n+2}$ ). Crude petroleum is first separated into two portions, which are further separated by fractional distillation and purification into other portions, which are sold under various names, but are commonly grouped as naphthas, illuminating oils, lubricant oils, paraffins, and coke. The portion distilling between  $50^\circ$  and  $60^\circ C.$ , which consists mainly of pentane and hexane, is official in the Appendix of the Pharmacopœia as Petroleum Spirit. (It is more usually called Petroleum Ether, and is used as a solvent.) The next portion, distilling between  $60^\circ$  and  $90^\circ C.$ , consists mainly of hexane and heptane, and is known commercially as petroleum benzine (not benzene,  $C_6H_6$ ). The next distillate, coming over between  $90^\circ$  and  $120^\circ C.$ , is principally heptane and octane, and is known as ligroin or light petroleum. That distilling between  $120^\circ$  and  $300^\circ C.$  is used under various names (kerosene, &c.) for illuminating purposes. The portion distilling between  $330^\circ$  and  $390^\circ C.$  is used for making the official Paraffinum Liquidum. The residue forms the basis for preparing soft paraffin, Paraffinum Molle, or vaseline. Paraffinum Durum is obtained from bituminous shale.

**Paraffinum Liquidum.**—A mixture of high boiling liquid paraffins. It should not boil below  $360^\circ C.$

Prepared by purifying the crude distillate by washing with sulphuric acid and caustic soda solution, decolourising by filtering through charcoal and re-distilling.

*Characters.*—A colourless oily liquid without taste or odour. Insoluble in water, slightly soluble in absolute alcohol, readily in ether, chloroform, the fixed and volatile oils. It dissolves iodine, iodoform, phosphorus, and various other substances.

Specific gravity 0.885 to 0.890. It should contain no acids or sulphur compounds and not more than traces of other organic substances. (Canadian and some American petroleumcs contain sulphur compounds which are liable to contaminate the product.)

*Pharmacology.*—Externally it is almost purely protective, and is occasionally used as a basis for the local application of medicines. It has been given as an emulsion by the mouth in diseases associated with emaciation, but is of little value. It is not absorbed to any appreciable extent, and undergoes no changes in the body.

**Paraffinum Molle**—vaseline. A soft unctuous mixture of paraffins of high molecular weight.



Prepared by purifying, in the manner referred to under *Paraffinum Liquidum*, the least volatile portions of American petroleum. The white variety is made by bleaching the ordinary yellow variety.

*Characters*.—White or yellow, semi-solid, translucent, almost without taste or odour. Insoluble in water, slightly soluble in absolute alcohol, readily soluble in ether, chloroform, the fixed and volatile oils. It melts at  $35.5^{\circ}$  to  $40^{\circ}\text{C}$ .

It should contain no fixed oils, fats, resins, or sulphur compounds, and should give no reaction with litmus.

*Pharmacology*.—It is purely protective. It is not absorbed by the skin, and substances mixed with it do not readily penetrate into the skin. It is used to protect the skin from irritation by air or water, and as a basis for ointments. It is, however, too soft for most purposes unless combined with a considerable amount of powder or a substance of firm consistence.

**Unguentum Paraffini**.—See below.

**Paraffinum Durum**.—A mixture of several solid paraffins.

Prepared from the purified ‘oily tar’ obtained from the destructive distillation of certain bituminous shales, by separating the liquid portions by refrigeration, and purifying the product.

*Characters*.—Colourless, semi-transparent, crystalline masses, slightly greasy to the touch, without taste or odour. Insoluble in water, slightly soluble in absolute alcohol and in ether.

Melting-point  $54.4^{\circ}$  to  $57.2^{\circ}\text{C}$ . Sp. gr. 0.82 to 0.94. It should contain no acid, alkali, or mineral ash.

*Pharmacology*.—It is purely protective, but is too hard for use alone. It is employed mainly to increase the consistence of soft paraffin so as to make a suitable ointment basis.

**Unguentum Paraffini**.—Consists of hard paraffin 3, soft paraffin 7.

The proportions may be varied if the prevailing temperature require it.

As a basis for white substances, white soft paraffin should be used; for coloured substances the yellow variety of soft paraffin is advised.

*Pharmacology.*—It is simply protective. It is used as the basis of a large number of ointments, mainly because it does not go rancid. It does not penetrate into the skin readily, and therefore should not be used to make ointments which are required to penetrate deeply.

## ALCOHOLS, ETHERS, &c. ; CHLORO-DERIVATIVES

Many of the simpler members of the aliphatic group possess certain common pharmacological actions, of which a depressant action on the nervous system, and more especially the cerebrum, is the chief. These compounds are the alcohols, ethers, certain esters, aldehydes and ketones, and the halogen (more especially the chloro-) derivatives. These substances do not dissociate in solution, and are not decomposed to any appreciable extent before absorption; they therefore act as intact molecules. Their mode of action is not completely known; whether it is mainly physical or chemical, for example, is still undetermined.

The best-known member of the group is ethylic alcohol, the intoxicating effects of which are well known. The formula of this substance is  $C_2H_5OH$ , and its action is usually attributed to the alkyl radical  $C_2H_5$ . For purely descriptive purposes this supposition is convenient; it enables us to state in general terms most of the components of this pharmacological group. Thus we may say that all mon-alkyl radicals of this type, if not combined with a powerful pharmacologically active radical or a carboxyl group (acids), will exert a depressant action on the brain, provided that the resulting compound is soluble in water. The higher alcohols—propyl, butyl, amyl—possess an action comparable to that of ethyl alcohol; but the alcohols still higher in the series are too insoluble in aqueous media to be able to exert much effect. When an alkyl radical, say ethyl, is united to a comparatively inactive radical, as in ethyl acetate, the pharmacological action of the compound is very similar to that of the alcohol. If, however, the acidic radical has a powerful effect, as in ethyl nitrite, the action of the alkyl is eclipsed.

This question of the relation between chemical constitution and pharmacological action is too extensive and intricate to be even summarily considered here. But the example of the chlor-methanes may be

referred to. The introduction of chlorine into simple organic compounds often confers on them narcotic properties. Methane has only a narcotic action in virtue of its being pharmacologically an inert gas. But when chlorine is introduced into the molecule and mono-chlor-methane,  $\text{CH}_3\text{Cl}$ , obtained, a well-marked narcotic effect is developed. This is more marked in di-chlor-methane,  $\text{CH}_2\text{Cl}_2$ , and still more marked in tri-chlor-methane (chloroform),  $\text{CHCl}_3$ . It is, however, much less obvious in tetra-chlor-methane,  $\text{CCl}_4$ , partly owing to the very slight solubility of this substance. The chlor-derivatives of ethane form a similar pharmacological series. It must not be supposed, however, that the action is in any sense a chlorine action.

### ALCOHOL

Ethylic alcohol of various strengths is official in the Pharmacopœia. It is also the main active ingredient in brandy and two wines which are official.

**Alcohol Absolutum.**—‘Ethyl hydroxide,  $\text{C}_2\text{H}_5\text{OH}$ , with not more than 1 per cent., by weight, of water.’

Prepared by removing water from the strong commercial alcohol (95 to 96 per cent.) by means of dehydrating agents (*e.g.* quick-lime) and re-distilling.

*Characters.*—Similar to those of rectified spirit (see below). It is more volatile, and has a lower specific gravity. It is also hygroscopic and takes up water quickly if exposed to the air.

The presence of excess of water is detected by adding anhydrous copper sulphate to the alcohol in a well-closed bottle and shaking occasionally. If after 2 to 3 hours the salt becomes decidedly blue, an excess of water is present. Sp. gr. 0.794 to 0.797.

It is used in preparing Liquor Ethyl Nitritis and Liquor Sodii Ethylatis, and as a solvent.

**Spiritus Rectificatus**—alcohol (90 per cent.). ‘A liquid containing 90 parts by volume of ethyl hydroxide,  $\text{C}_2\text{H}_5\text{OH}$ , and 10 parts by volume of water’; or 85.65 per cent. and 14.35 per cent. by weight respectively.

Prepared by fermenting the sugar obtained from the starch of cereals or potatoes, or molasses, and distilling.

Most of the alcohol prepared in this country is made from barley. Part of this is first malted to obtain the ferment diastase, and then mixed

with the remainder and water, and the whole is kept at a temperature of about 60°C. (below 63°C.). The starch of the grain is converted into maltose and dextrin, the conditions being arranged to obtain as little dextrin as possible. The mixture is then rapidly cooled and yeast added, which decomposes the sugars formed into alcohol and carbon dioxide. When the mixture contains 14 to 15 per cent. of alcohol the action of the yeast is inhibited. In practice the conditions are so arranged that the sugars are exhausted before this point is reached. The product is then subjected to distillation, and the distillate is purified by dilution with water, filtration through charcoal, and fractional distillation. During the fermentation small quantities of higher monhydric alcohols, aldehyde, acetic and succinic acids, glycerin, &c. are formed (from 5 to 8 per cent. of the sugar) and are liable to contaminate the product. The higher boiling products constitute the so-called 'fusel oil,' the most important component of which is amyl alcohol.

*Characters.*—A colourless, transparent, mobile, and volatile liquid, with a characteristic odour and a spirituous burning taste. It is inflammable, and burns with a blue smokeless flame. It is miscible in all proportions with water, and is a solvent of most organic and some inorganic substances; but inorganic carbonates and many inorganic salts are insoluble in it.

It should contain not more than traces of amylic alcohol or aldehyde, and no other impurity (oily or resinous substances, tannic acid, fixed matter, &c.).

**Diluted Alcohol.**—Four strengths are official. They contain, respectively, **70 per cent.**, **60 per cent.**, **45 per cent.**, and **20 per cent.**, by volume, of ethyl hydroxide.

They are prepared by diluting rectified spirit with the proper amount of distilled water. As contraction of volume and rise of temperature occur when rectified spirit and water are mixed, it is necessary to allow for these when making the diluted alcohol. Thus 70 per cent. alcohol is prepared by mixing together 100 volumes of 90 per cent. alcohol and 31 volumes of distilled water.

*Pharmacology.*—When applied to the skin, alcohol produces a sensation of coldness, owing to the abstraction of heat by its evaporation. If evaporation is prevented, strengths above 60 per cent. irritate and cause redness. Weaker strengths produce no marked effect unless frequently applied, when they induce hardening of the skin. To mucous



membranes and denuded surfaces, alcohol of 40 per cent. strength is irritant; pure alcohol is astringent or even mildly caustic; it abstracts water to a slight degree, and precipitates the superficial albuminous substances. It is not generally used as an astringent, because its action is transient, owing to the precipitated albumen being readily soluble in aqueous media.

Alcohol of 60 per cent. strength is disinfectant (bactericidal). Weaker solutions (under 50 per cent.) are only antiseptic.

When taken by the mouth in dilute solution it produces a feeling of warmth in the mouth and reflexly excites salivation and increased gastric secretion. Pure alcohol produces a burning sensation. In the stomach small doses are carminative and mildly stimulant; there is a feeling of warmth, the gastric secretion is slightly increased, and the gastric movements are regulated. The gastric contents pass more quickly into the duodenum, and absorption from the stomach and intestine is accelerated. Large doses of alcohol irritate the mouth and stomach, and produce burning pain and retard digestion.

Alcohol is rapidly absorbed, and acts on nearly all the tissues of the body. After single doses its most obvious action is on the brain. There is a feeling of well-being, and the functions of the brain seem to be stimulated, but in most people they are really depressed. If the amount taken is sufficient, this condition passes through one of intoxication, into somnolence, and finally sleep. Accompanying these effects are dilatation of the cutaneous vessels, a sensation of warmth, and transient diuresis. The temperature in reality falls, but after moderate doses, not more than 1°–2°F. The heart is but little influenced. It is generally said to be stimulated, but any stimulant effect, beyond that induced reflexly through the alimentary canal, is comparatively slight.

In the blood, alcohol is gradually broken up into carbon dioxide and water. Heat is thus produced, and consequently alcohol may be regarded as a food. Indirectly it is a proteid-saver, since it can replace a certain proportion of

carbo-hydrate material. Nearly all the alcohol taken is decomposed; after ordinary doses only a small percentage is excreted in the urine.

After continued use, alcohol frequently leads to pathological changes in the tissues of the body. These are mainly an increase in the interstitial tissue of organs and fatty degeneration of cells. The organs do not suffer uniformly; one or more may be much more influenced than the rest. Consequently the symptoms vary. The individual may come under observation suffering from heart disease (dilatation), hepatic disease (cirrhosis), kidney disease (chronic Bright's disease), nervous affections (insanity, peripheral neuritis, and others), or chronic gastric catarrh. The last-named is commonly present, and is due mainly to the direct action of the alcohol on the gastric mucous membrane. An enlarged and tuberculated nose (*acne rosacea*) is also common. Apart from any manifest signs of disease, alcoholic individuals are more liable to contract other diseases, on account of the depressed condition of their tissues.

Alcohol (diluted) is used externally as an evaporating lotion in inflammations of the skin, sprains, &c., and to diminish the secretion of sweat. It is used to harden the epidermis and prevent bed-sores, and is also employed as a bactericide to disinfect the skin (hands of surgeon, &c.), before operation. For this purpose 60 or 70 per cent. alcohol should be employed.

Internally it is given as a stimulant and carminative in gastric disease, as a stimulant in heart disease, as a food in fevers, convalescence, &c., and sometimes as a hypnotic in sleeplessness, but for the last purpose it is better avoided. As a stimulant in cardiac weakness its beneficial influence has been overrated, although it is undoubtedly useful. As a food its value is limited. It is doubtful if more than four to six ounces a day is beneficial, and this should be given in small quantities at frequent intervals. It has been used as an antipyretic, but is of little value.

The dilute alcohols of the *Pharmacopœia* are merely official for the making of preparations.

**Spiritus Vini Gallici**—brandy. ‘A spirituous liquid distilled from wine and matured by age, and containing not less than  $36\frac{1}{2}$  per cent. by weight or  $43\frac{1}{2}$  per cent. by volume of ethyl hydroxide.’

*Characters*.—A brownish liquid with a characteristic taste and odour. It is slightly acid.

It contains, besides alcohol, various ethers which give to it most of its characteristic taste and odour. It also contains a small quantity of aldehyde, tannin, and other substances. The colour is derived from the casks in which it is matured, or, in part, may have been added. A considerable amount of the brandy sold is fictitious.

*Pharmacology*.—Very similar to that of alcohol of corresponding strength. The ethers present in it make it more pleasant and pungent to the taste and increase its reflex effects, but it is doubtful if they do more than this. This action, however, makes it more efficacious in disease, and alcohol is commonly administered internally in this form.

**Mistura Spiritus Vini Gallici**.—A yellow mixture containing yolk of egg, sugar, and equal parts of brandy and cinnamon water.

Two yolks of eggs are rubbed together with sugar  $\frac{1}{2}$  oz. and cinnamon water 4 fl. oz. and brandy 4 fl. oz. added.

*Dose, as a draught*—1 to 2 fluid ounces.

*Pharmacology*.—Mainly that of brandy. The yolks make it somewhat nutritious and also diminish the irritant effect of the spirit. It is often useful in convalescence.

**Vinum Xericum**—sherry. ‘A Spanish wine.’ It should contain not less than 16 per cent. of ethyl hydroxide by volume.

It is prepared by fermenting fresh grape juice (‘must’).

It contains besides alcohol various ethers (œnanthylic, &c.) essential oil, glucose, vegetable acids (tartaric, malic) and their salts, tannin, etc. Sometimes plaster of Paris is added to the ‘must,’ a process technically known as ‘plastering.’ It is said to aid the clarification of the wine, but it induces changes in it, ‘plastered’ wine being relatively richer in potassium and sulphates and poorer in tartrates. The fermented juice contains about 13 per cent. of alcohol, and it is necessary to add a little alcohol to improve its keeping qualities. In the poorer wines salicylic acid is sometimes used for the same purpose.

*Characters.*—A pale yellowish-brown wine with a characteristic taste and aroma.

It should not contain salicylic acid.

It is official for making four medicated wines (see page 48).

**Vinum Aurantii.**—‘ Wine made by the fermentation of a saccharine solution, to which fresh bitter orange peel has been added.’ It should contain 10 to 12 per cent. by volume of ethyl hydroxide.

*Characters.*—A pale yellowish-brown wine with the taste and aroma of bitter orange peel. It is slightly acid.

It should contain no salicylic acid and not more than traces of sulphites.

It is used in making two official wines (see page 48).

## ACETIC ETHER

**Æther Aceticus.**—‘ An ethereal liquid consisting of ethyl acetate,  $\text{CH}_3\cdot\text{COO}(\text{C}_2\text{H}_5)$ , together with unimportant amounts of other substances ’ (of alcohol, water, &c.).

Prepared by distilling a mixture of ethylic alcohol, sulphuric acid and dried sodium acetate, digesting the distillate with dried potassium carbonate to neutralise the acetic acid formed and abstract water, and fractionally distilling the liquid. The portion coming over between  $74^\circ$  and  $78^\circ\text{C}$ . is the official product.

*Characters.*—A colourless mobile liquid with a characteristic fragrant odour. Soluble in about 12 parts of water; miscible in all proportions with alcohol, ether, or chloroform. It is a solvent of many organic substances.

The Pharmacopœia gives the solubility in water as 1 in not less than 10 parts by weight. Greater solubility would indicate excess of water or alcohol. The solubility of pure ethyl acetate is 1 in 14 of water. The solution should be neutral.

It is used in preparing Liquor Epispasticus.

*Dose*—20 to 40 minims for repeated administration; 60 to 90 minims for a single administration.

*Pharmacology.*—Its action closely resembles that of alcohol in most respects. It is very fragrant and is one of



the esters occurring in brandy and wines. It has been used as a carminative and cardiac stimulant; and also as an inhalation in laryngeal and bronchial troubles; but it is not much employed.

### ETHER

Ether—ethyl ether—is official in two forms, ordinary ether and purified ether.

**Æther Purificatus.**—Almost pure ethyl ether,  $(C_2H_5)_2O$ . It contains a negligible quantity of alcohol and water.

Prepared by washing ether with distilled water to remove alcohol and afterwards distilling the supernatant liquid in the presence of calcium chloride and recently prepared lime to remove water.

*Characters.*—A colourless mobile liquid, having similar general characters to ether. It has a lower specific gravity and boiling-point. The latter is  $35^{\circ}C$ .

It should not commence to boil under  $34.5^{\circ}C$ . Sp. gr. 0.720 to 0.722. It should contain no methylic ether (determined by boiling-point); no aldehyde (no brownish discoloration after adding potassium hydroxide); no acid (no alteration of moistened blue litmus-paper after 24 hours); and no hydrogen peroxide (produced when ether is stored in the light).

It should form a clear solution with an equal volume of carbon disulphide (absence of excess of water).

*Pharmacology.*—Similar to that of ether (see below). It is used for producing general anæsthesia. It was used for inducing local anæsthesia, but has been superseded by more recently introduced substances. For these purposes it is advisable to have ether as free from alcohol and water as possible.

**Æther.**—A volatile liquid containing not less than 92 per cent. by volume of ethyl oxide,  $(C_2H_5)_2O$ .

Prepared by distilling a mixture of ethylic alcohol (5 parts) and sulphuric acid (9 parts), more alcohol being slowly run in when the temperature has reached  $140^{\circ}C$ . The product, which consists of ether, water, and alcohol is shaken with caustic soda, and the supernatant liquid is siphoned off and distilled over lime. It was formerly termed sulphuric ether.

*Characters.*—A colourless, very mobile, and volatile liquid with a strong characteristic odour. It gives off a heavy, very inflammable vapour, which forms an explosive mixture with air. Soluble in 10 parts of water; miscible in all proportions with alcohol, chloroform, and fixed and volatile oils. The mixture with chloroform is slightly turbid, owing to the water in the ether.

It should boil below  $40.5^{\circ}\text{C}$ . Sp. gr. 0.735. It should not contain excess of alcohol (shaken with an equal volume of water the volume of ether should not be reduced more than one tenth), it should not be acid or leave any residue on evaporation; and it should not contain organic impurities (no coloration on dropping into cooled sulphuric acid).

*Dose.*—10 to 30 minims, for repeated administration; 40 to 60 minims for a single administration.

*Pharmacology.*—Its action is in many respects similar to that of alcohol. It is more volatile, and hence when applied to the skin it produces a greater sensation of coldness, owing to the more rapid evaporation. By spraying the ether the evaporation is sufficiently rapid to produce freezing of the tissue, and as a consequence loss of sensation (local anæsthesia) results. The return to normal is decidedly painful. Ether also differs from alcohol in being more stable. It is not known to be broken up in the body to any extent; nearly the whole is excreted in the breath.

When taken by the mouth it has a somewhat unpleasant taste, induces reflex salivation, acts as a stimulant and carminative to the stomach, and is quickly absorbed. It stimulates the heart, both directly and reflexly through the upper respiratory passages and stomach, and it depresses the cerebral functions. Intoxication similar to but often more boisterous than that of alcohol may be produced, but it quickly passes away.

When ether vapour is inhaled in almost a pure form it produces a sense of suffocation and rapid loss of consciousness. If somewhat more dilute, the four stages of anæsthesia are readily discernible—(1) disordered consciousness ending in loss of consciousness; (2) unconscious reflex activity manifest especially in muscular rigidity; (3) surgical anæsthesia in

which there is complete muscular relaxation and no obvious reflex actions ; (4) bulbar paralysis, characterised by stoppage of the respiration and later of the heart. These various stages pass imperceptibly into one another. The symptoms in each stage are fairly definite, but they vary considerably in different individuals. During the stage of surgical anæsthesia the pulse should be regular and fairly full (it is generally somewhat slower than normal), the respiration should be regular and slow (it may be noisy—‘stertor’), the pupils somewhat contracted and sensitive to light, and the conjunctiva generally sensitive to the touch. The masseters may still retain slight ‘tone.’ The skin is usually moist and warm.

After the inhalation of the ether has been discontinued the patient gradually recovers. The time of recovery varies with a number of conditions, but usually within half an hour he has largely regained his normal state. Certain after-effects, such as vomiting, may occur ; and bronchial catarrh may result, especially if any tendency to bronchial troubles exists.

As ether is very volatile, it is difficult to induce anæsthesia by administering it on lint, a towel, or a mask (so-called ‘open method’), it is therefore inclosed in a chamber through which a variable portion of the inspired air can be made to pass (so-called ‘closed method’). Clover’s inhaler, or a modification of it, is generally used.

Ether is not much employed externally. As a local anæsthetic it has been replaced by substances still more volatile. It is also comparatively rarely given in mixtures or as a draught except in the form of the spirit of ether (see below). It is frequently given hypodermically in syncope from various causes. Its effect is partly due to the local irritation it induces when administered in this way.

It is used mainly as a general anæsthetic, and is given by inhalation. Excluding nitrous oxide, it is the safest general anæsthetic we possess. It cannot, however, be used in the presence of naked lights (cautery, &c.), owing to its inflammability ; and it is usually not advisable to use it if bronchial or pulmonary disease exist. Children do not take it readily,

both on account of its unpleasant smell and because it necessitates the use of an inhaler.

**Spiritus Ætheris.**—A mixture of ether 1, alcohol (90 per cent.) 2, by volume.

*Dose.*—20 to 40 minims for repeated administration; 60 to 90 minims for a single administration.

*Pharmacology.*—Its action is that of its constituents. It is used mainly as a carminative in gastric affections and colic, and as a cardiac stimulant in syncope or weakness of the heart.

**Spiritus Ætheris Compositus.**—Hoffmann's anodyne.<sup>1</sup> A solution of 'light oil of wine' (mainly ethyl sulphate) in ether and alcohol.

Prepared by gradually adding sulphuric acid 36 fl. oz. to alcohol (90 per cent.) 40 fl. oz., and allowing to stand 24 hours. Then distil slowly until the temperature of the mixture becomes 171.6°C. Allow the distillate to separate into two layers. Wash the upper layer with a solution of sodium bicarbonate until neutral. Add it to ether 5½ fl. oz., and alcohol (90 per cent.) 38 fl. oz.

The reaction between the alcohol and sulphuric acid is a complex one. The distillate is said to contain mono- and di-ethyl sulphates, ethylene sulphate, some ether, sulphurous acid, dissolved ethylene and other substances. The product separates into two layers, the upper being the ethereal one. It is liable to be contaminated with sulphurous acid, hence the washing with sodium bicarbonate solution.

*Characters.* — A colourless mobile liquid with a characteristic somewhat unpleasant ethereal odour and taste. It gives a clear solution with less than twice its volume of water, but with more than this the mixture is slightly opalescent.

It should contain no empyreumatic impurities (no residue with an unpleasant odour after evaporation).

*Dose.*—20 to 40 minims for repeated administration; 60 to 90 minims for a single administration.

*Pharmacology.*—Its action is very similar to that of simple spirit of ether. It is a useful carminative, a mild expectorant, and as a stimulant is of value in cardiac weakness.

<sup>1</sup> Hoffmann's anodyne on the Continent is simple spirit of ether.



## CHLOROFORM

**Chloroformum.** — Chloroform or trichlormethane,  $\text{CHCl}_3$ , containing about 1 per cent. of absolute alcohol.

Prepared by distilling a mixture of alcohol or acetone, chlorinated lime, and water, or a mixture of caustic alkali and chloral or chloral hydrate. The product is purified by shaking with sulphuric acid, then with lime and redistilling. Sufficient absolute alcohol is then added to produce a liquid with a specific gravity of 1.490 to 1.495. The alcohol is supposed to act as a preservative.

*Characters.*—A colourless mobile liquid with a characteristic odour and sweet burning taste. It is volatile at ordinary temperatures, and boils between  $60^\circ$  and  $62^\circ\text{C}$ . Soluble in 110 parts of water; miscible in all proportions with alcohol, ether, olive oil, and oil of turpentine. It decomposes slightly on exposure to heat and light, and therefore should be kept in a cool dark place. The most important decomposition products are hydrochloric and formic acids, but chlorine and carbonyl chloride may occur. Impurities from faulty manufacture (various chloro-derivatives, aldehyde, &c.) are rarely found nowadays. The pharmacopœial tests show that it contains no acid, no free chlorine, no chlorides, no organic substances affected or dissolved by strong sulphuric acid, or substances having a distinctive odour, and no fixed residue.

The presence of acid is determined by shaking chloroform with a little water and testing with litmus. Chlorine is detected by the starch-iodide test; chlorides by the addition of solution of silver nitrate; organic impurities by shaking with a small quantity of strong sulphuric acid for twenty minutes and allowing the liquids to separate; the sulphuric acid should be transparent and colourless, and should remain so on dilution with water, and even after the addition of four drops of solution of silver nitrate. When gently evaporated on a piece of filter paper, no foreign odour should be perceptible during or after evaporation. A few drops of chloroform water added to a drop of aniline in alcoholic potash and warmed produces the powerfully penetrating odour of phenyl iso-nitrile.

*Dose.*—1 to 5 minims.

*Pharmacology.*—When applied to the skin, chloroform produces a sensation of coldness if allowed to evaporate, but if evaporation is prevented, or if the chloroform is rubbed into

the skin, it produces redness and a transient burning sensation, followed by slight numbness. Applied to mucous membranes it causes transient burning pain. Taken by the mouth it has a sweet burning taste, produces reflex salivation, and, in small doses, acts as a carminative in the stomach; if in large quantity it causes burning pain in the stomach, which is soon followed by a comatose condition owing to the absorption of the drug and its depressant action on the brain.

It is given internally as a carminative, and is used as a sweetening agent. It has been given in large doses for tapeworm, but cannot be recommended. Externally it is occasionally employed as a liniment for neuralgia. It is also frequently applied to an aching tooth. Chloroform water is antiseptic, and it is sometimes used as such (see page 218).

Chloroform is most frequently administered by inhalation. When the dilute vapour is inhaled it produces a series of symptoms closely similar to those seen after the inhalation of ether. The excitement and muscular rigidity are not usually so well marked, but there is little essential difference.

Chloroform is much more powerful than ether, and is also much less volatile. It may therefore be administered on a piece of lint, a towel, or an open mask ('open method'). It is thus more convenient to administer than ether, and it is also pleasanter to take. Its greater toxicity, however, more than counterbalances its good points, and it should only be preferred to ether where convenience is a matter of moment, or where, owing to the existence of pulmonary disease or to the nature of the operation, ether is contra-indicated. Besides its use as a general anæsthetic for operations, chloroform is inhaled for asthma and other spasmodic and convulsive disorders.

Chloroform is excreted as such mainly in the breath, to a much less extent in the urine. An insignificant proportion undergoes decomposition.

**Aqua Chloroformi.**—An aqueous solution containing 1 of chloroform in 400 by volume.

Chloroform 30 minims; distilled water to make 25 fl. oz.

*Pharmacology.*—It has a sweet characteristic taste, produces reflex salivation, and acts as a carminative in the stomach and intestines. It is absorbed, and in full doses produces slight cerebral depression, and helps to relieve any existing spasmodic condition. It is somewhat antiseptic: it will inhibit the activity of micro-organisms and kill many of them, but it has little influence on their spores. It has been used as an antiseptic to wash out the bladder in cystitis and similar conditions.

It is used mainly as a flavouring and carminative agent.

**Linimentum Chloroformi.**—Consists of equal volumes of chloroform and liniment of camphor.

*Pharmacology.*—It produces a stimulant followed by a sedative effect. It is sometimes of service in superficial neuralgia and other painful affections, but it often fails to give much relief.

**Spiritus Chloroformi.** — A 1 in 20 solution (by volume) of chloroform in alcohol.

Chloroform 1 fl. oz.; alcohol (90 per cent.) to make 20 fl. oz.

*Dose.*—5 to 20 minims for repeated administration; 30 to 40 minims for a single administration.

*Pharmacology.*—It is a useful carminative, antispasmodic, and sweetening agent. It is used, mainly combined with other substances, in the form of mixtures, rarely alone. It is sometimes given for hiccough, flatulence, vomiting of pregnancy, asthma, &c.

**Tinctura Chloroformi et Morphinae Composita.**—A dark-greenish tincture containing  $\frac{3}{4}$  minim of chloroform,  $\frac{1}{2}$  minim of diluted hydrocyanic acid,  $\frac{1}{1}$  grain of morphine hydrochloride, and 1 minim of tincture of cannabis indica, in 10 minims. It also contains oil of peppermint and tincture of capsicum (see page 320).

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action is mainly that of morphine (see page 307).

IODOFORM

**Iodoformum**—tri-iodomethane.  $\text{CHI}_3$ .

Prepared by warming a mixture of iodine, ethylic alcohol, potassium carbonate, and water; and in other ways.

*Characters*.—Small, brilliant, lemon-yellow, hexagonal crystals, somewhat unctuous to the touch, with a characteristic persistent odour and a disagreeable taste. Very slightly soluble in water, soluble in 80 parts of alcohol, in 5 parts of ether, in 14 parts of chloroform, in 30 parts of olive oil, in about 100 parts of glycerin; soluble also in carbon bisulphide, and in fixed and volatile oils.

When heated it melts (at  $119^\circ\text{C}$ .) to a brown liquid, and then gives off brown and violet vapours, leaving a black residue which entirely disappears on further heating. It is decomposed on warming with alcoholic potash into potassium iodide and formate.

It should contain no colouring matters, acid (picric acid), iodide, or other impurity.

*Dose*.— $\frac{1}{2}$  to 3 grains.

*Pharmacology*.—Although similar in chemical constitution to chloroform, iodoform has a very different pharmacological action. Instead of narcosis, it produces, in man, maniacal excitement.

Applied to wounds, it is sedative and mildly antiseptic, and diminishes any tendency towards suppuration. After repeated application it occasionally produces a local skin eruption. If applied over extensive areas it may be absorbed and produce poisonous symptoms, commencing with the characteristic taste in the mouth, sometimes nausea and vomiting, headache, restlessness and sleeplessness, and terminating with delirium and even acute mania, or, in some cases, coma.

Iodoform itself is not bactericidal. But in contact with albuminous matter it undergoes slight decomposition, and free iodine is probably first formed. This is believed to be the antiseptic agent. Iodoform is, however, absorbed unchanged



from wounds, and although a similar decomposition occurs in the blood, the symptoms of poisoning are due to the action of the intact molecule. Iodoform is excreted in the urine mainly as iodides.

It is used chiefly in the treatment of wounds, and especially of syphilitic and tubercular ulcers. Its powerful, penetrating odour is, however, objectionable. It has also been injected, dissolved in oil or ether or suspended in a glycerin or aqueous medium, into tubercular joints, 'cold abscess,' &c., but owing to its liability to be absorbed it is of questionable value. This objection, however, does not apply to the treatment of sinuses, on account of their small size.

Iodoform has been given by the mouth in tuberculosis and as an intestinal antiseptic, and it has also been injected subcutaneously and into tissues in tubercular and other affections, but it is of very doubtful value.

**Suppositoria Iodoformi.**—Each suppository contains 3 grains of iodoform.

The basis is oil of theobroma (12 grains in each).

*Pharmacology.*—Sedative and mildly antiseptic. Used in diseases of the lower part of the rectum—hæmorrhoids, anal fissure, cancer, &c.

**Unguentum Iodoformi.**—Consists of iodoform 1, yellow paraffin ointment 9.

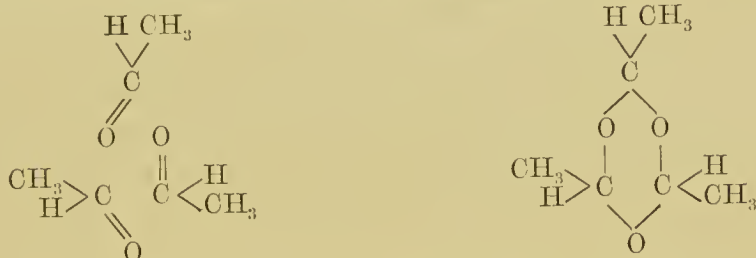
*Pharmacology.*—A sedative and mildly antiseptic ointment. Used for syphilitic, tubercular, and cancerous ulcers, as a remedy for burns, and various other affections.

The following four compounds are hypnotics (sleep-inducers), and, with the exception of butyl-chloral hydrate, are largely used as such. In many respects their action is similar to that of alcohol and chloroform, the differences consisting largely of differences in physical character and in the predominant ill-effects to which they give rise.

## PARALDEHYDE

**Paraldehydum**— $C_6H_{12}O_3$ . A polymer of aldehyde.

Prepared by polymerising aldehyde by means of various acids and salts, *e.g.* hydrochloric and sulphuric acids, and zinc chloride. On addition of small quantities of these to aldehyde polymerisation occurs with evolution of heat and contraction of volume. By cooling the solution to  $0^\circ C$ . paraldehyde crystallises out and after separation is purified by distillation. Three molecules of aldehyde unite to form one of paraldehyde. The change may be expressed thus—



A closed chain is formed and consequently paraldehyde does not give the reactions of an aldehyde (reduce silver ammonio-nitrate, etc.) Aldehyde may be obtained from paraldehyde by acidifying and distilling.

*Characters.*—A clear, colourless, mobile liquid, with a characteristic, aldehyde-like odour, and a somewhat acrid, burning taste. Soluble in 10 parts of water, less soluble in hot water; miscible, in all proportions, with alcohol or ether.

Boiling-point  $124^\circ C$ . On cooling to  $0^\circ C$ . it crystallises, melting again at about  $10^\circ C$ . It should contain no aldehyde (give no coloration with caustic potash solution on standing) or sulphates, and should be neutral to litmus.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—It has an unpleasant burning taste, and, unless completely dissolved in water, is liable to cause gastric irritation. It is generally well borne, is rapidly absorbed, and quickly produces sleep, preceded sometimes by slight excitement. After full pharmacopoeial doses sleep is apparently normal, and the individual awakens after six to nine hours feeling refreshed, but sometimes suffering from heaviness, headache, and occasionally nausea. There is commonly an unpleasant taste in the mouth, and the breath has the characteristic smell of paraldehyde. It is excreted in the

breath and in the urine. The quantity of urine passed is increased.

The advantages of paraldehyde as a hypnotic are its safety and rapidity of action, and its comparative freedom from ill-effects and after-effects. It produces no serious depression of the circulatory or respiratory systems, and on account of its unpleasant taste it does not tend to induce a 'habit.' If a habit is acquired it is easily detected by the smell of the breath.

Its disadvantages are its unpleasant taste and smell, and its liability to irritate mucous membranes. Thus it is contra-indicated if gastric catarrh is present, and is better avoided in patients with a troublesome cough. Otherwise it is a hypnotic of wide application.

It should not be given subcutaneously or by inhalation, on account of its irritant action.

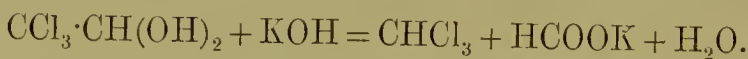
#### CHLORAL HYDRATE

**Chloral Hydras**—trichlor-ethylidene glycol.



Prepared by passing chlorine into ethylic alcohol, decomposing the chloral alcoholate formed by means of sulphuric acid, and distilling; to the liquid chloral thus obtained an equi-molecular amount of water is added.

*Characters.*—Colourless crystals, with a characteristic pungent odour, and a warm, bitter, afterwards slightly acrid, taste. Soluble in less than half its weight of water or alcohol, in less than its weight of ether or glycerin, in 4 parts of chloroform, in 1 part of olive oil, and in about 10 parts of oil of turpentine. Its aqueous solution should be neutral or very slightly acid. Alkalies decompose it, forming chloroform, which is readily detected by the smell, and a formate.



Chloral hydrate gives the phenyl iso-nitrile test characteristic of chloroform on account of this reaction. It fuses at  $57^\circ\text{C}.$ , and distils (if mixed with pieces of broken porcelain) at  $95^\circ$  to  $97^\circ\text{C}.$  It should contain no organic substances charred by sulphuric acid, no chloral alcoholate,

and no chlorides. The presence of chloral alcoholate is unimportant pharmacologically.

*Dose.*—5 to 20 grains.

**Syrupus Chloral.**—A colourless syrup, containing 10 grains of chloral hydrate in 1 fluid drachm.

Chloral hydrate, 80 gr.; distilled water,  $1\frac{1}{2}$  fl. dr.; syrup, to make 1 fl. oz.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

It is simply a convenient preparation for administering chloral hydrate.

*Pharmacology.*—Kept in contact with the skin, chloral hydrate in fine powder produces irritation. The effect is slow in appearing, and does not readily pass beyond well-marked redness and comparatively slight burning pain.

When taken by the mouth it has a warm, bitter taste, but if well diluted it is easily taken and is well borne by the stomach. It is readily absorbed, and in full pharmacopœial doses quickly produces somnolence and finally sleep (in about half an hour). Occasionally it produces excitement. The sleep is apparently natural, and the individual awakens after 7 to 9 hours feeling refreshed but generally somewhat drowsy. After larger doses the sleep is more profound, and, according to the dose, approaches more or less closely a comatose condition. The heart and respiration are affected, the muscles are relaxed, the temperature falls, and sensibility and reflex action are markedly diminished.

The circulatory system is distinctly depressed by chloral hydrate. The heart is weakened and the blood-vessels are dilated. It is, therefore, not advisable to give it in heart disease.

Chloral hydrate is absorbed unchanged, but in the blood it is converted in part into trichlorethyl alcohol, which unites with glycuronic acid, forming trichlorethyl-glycuronic acid (formerly called urochloralic acid), and is excreted in the urine as such. The urine reduces Fehling's solution.

On account of the certainty with which it induces sleep, chloral hydrate is liable to induce a 'habit,' and sooner or



later a condition known as **chloralism**, or chronic chloralism, develops. This is usually characterised by chronic gastritis, mainly due to the local action of the drug on the gastric mucous membrane, by cutaneous eruptions, chiefly erythematous, and by psychical disturbances of various kinds.

Chloral hydrate solutions (10–20 per cent.) are antiseptic.

It is sometimes used externally as a counter-irritant, especially for subacute pain in and around joints, neuralgia, &c. For neuralgia it is frequently combined with camphor, the combination forming a syrupy liquid. It is most commonly given internally for sleeplessness from various causes, either alone or combined with bromides. It is also useful in convulsive disorders, such as puerperal convulsions, whooping-cough, false croup, chorea, asthma, &c., but it must be used with care and judgment. During parturition it is often beneficial, giving sleep and rest.

#### BUTYL-CHLORAL HYDRATE

**Butyl-chloral Hydras**—trichlor-butylic glycol.  
 $\text{CH}_3 \cdot \text{CHCl} \cdot \text{CCl}_2 \cdot \text{CH}(\text{OH})_2$ .

Prepared in a similar manner to chloral hydrate, using aldehyde in place of alcohol. The reaction is a complex one. A mono-chlor-aldehyde is apparently first formed, and this condenses with a molecule of aldehyde to form *α*-chlor-croton-aldehyde, which, being unsaturated, takes up two other atoms of chlorine. The liquid butyl-chloral obtained unites with water, as in the case of chloral, and forms a glycol.

*Characters.*—Small pearly-white crystals, unctuous to the touch, with a somewhat pungent odour, and an unpleasant bitter taste. Soluble in 40 parts of water, in 1 part of alcohol or glycerin, in 2 parts of ether, and in 20 parts of chloroform. Its aqueous solution is neutral or very slightly acid.

When heated with a solution of caustic alkali, it yields allylene dichloride,  $\text{CH}_3 \cdot \text{CCl} \cdot \text{CHCl}$ , not chloroform. If the latter is formed, chloral hydrate is present. It fuses at 78°C.

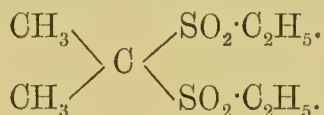
*Dose.*—5 to 20 grains.

*Pharmacology.*—It has no distinct external action, but is otherwise very similar to chloral hydrate. Its much smaller

solubility in aqueous media makes it apparently less active. It is excreted in the urine mainly as trichlor-butyl glycuronate. It is erroneously believed to have a specific action on the fifth cranial nerve, and is consequently used mainly in trigeminal neuralgia. It sometimes relieves, but more frequently fails.

## SULPHONAL

**Sulphonal**—dimethyl-diethylsulphon-methane.



Prepared by heating sodium ethyl thiosulphate and acetone in water containing a little hydrochloric acid, and subsequently oxidising the mercaptol,  $(\text{CH}_3)_2\text{C}(\text{SC}_2\text{H}_5)_2$ , formed.

*Characters.*—Colourless prismatic crystals, without odour and almost without taste. Soluble in 450 parts of water (at  $15.5^\circ\text{C}.$ ), in 15 parts of boiling water, in 80 parts of 90 per cent. alcohol (readily soluble in boiling alcohol), in 50 parts of ether, and in 3 parts of chloroform.

Melting-point,  $125.5^\circ\text{C}.$  When heated to redness in air it burns and gives off sulphur dioxide; if heated with dried sodium acetate, it evolves sulphuretted hydrogen. It is reduced by heating with an equal weight of potassium cyanide, mercaptan (which can be distinguished by its unpleasant odour) and potassium thiosulphate (detected by extracting the residue with water, acidifying with hydrochloric acid, and adding ferric chloride solution, when a red coloration is obtained) being formed. When heated with charcoal the odour of mercaptan is evolved. It should not contain chlorides, sulphates, or mineral matter.

*Dose.*—10 to 30 grains.

*Pharmacology.*—After doses of 20 to 30 grains, sulphonal usually produces no effect on the alimentary canal, but is slowly absorbed, and in  $1\frac{1}{2}$  to 2 or 3 hours produces somnolence and sleep. The sleep is apparently normal, but the individual generally feels drowsy on wakening, and even throughout the day, and not infrequently passes a good second night. In some cases sulphonal fails to act the first but postpones its action to the second night. These delayed

effects of sulphonal are due mainly to its comparative insolubility in water. They may be obviated to some extent by administering the substance in warm fluids, such as soup.

Sulphonal has no untoward effect on the heart or respiration. In large doses, or frequently repeated, however, it has a destructive influence on the blood.

If frequently administered, it produces symptoms of poisoning. These are mainly alimentary (gastric pain, vomiting, diarrhœa), nervous (headache, dizziness, weakness in the legs, unsteadiness, &c.), and renal (albuminuria, diminished urine, red colouring matter in urine, &c.). The presence of hæmatoporphyrin in the urine is characteristic.

Sulphonal is absorbed unchanged, and acts as such, but it is gradually decomposed, and is excreted, in large part, as ethylsulphonic acid. There is reason to believe that the ethyl groups in sulphonal are the most important factors.

It is used almost solely as a hypnotic. In single doses it is comparatively safe and not depressant to the heart, but in heart disease its action is often disappointing. Sulphonal is said to diminish the secretion of sweat when this is excessive, and it has consequently been given in pulmonary tuberculosis.

It should not be administered regularly for long periods without frequent intermissions of some days' duration.

The next four preparations contain an active acidic radical. The action of the alkyl group is consequently masked. In three cases this radical is the nitrite radical; in one case it is a nitrate. They all produce the same fundamental pharmacological effect, viz. dilatation of blood-vessels. If added to blood, the nitrites quickly change the colour of the blood to chocolate owing to the formation of met-hæmoglobin (see page 109).

#### SWEET SPIRIT OF NITRE

**Spiritus Ætheris Nitrosi.**—‘An alcoholic solution containing ethyl nitrite, aldehyde, and other substances.’ It should contain  $2\frac{1}{2}$  per cent., and never less than  $1\frac{3}{4}$  per cent. by weight of ethyl nitrite.

Prepared by heating a mixture of copper, sulphuric acid, nitric acid and alcohol, and collecting the distillate coming over between 77° and 79.5°C. in alcohol (90 per cent.), the receiver being kept cool by means of ice-cold water. The product is then diluted with alcohol (90 per cent.) until it contains  $2\frac{1}{2}$  per cent. by weight of ethyl nitrite.

It should be kept in small, well-stoppered, blue- or amber-coloured bottles in a cool, dark place.

*Characters.*—A slightly yellowish mobile liquid with a characteristic aldehyde and somewhat apple-like odour and a characteristic ethereal taste. When added to water it rapidly deteriorates (see below).

It deteriorates on keeping if the bottle containing it is frequently opened, partly on account of the volatility of ethyl nitrite, partly owing to hydrolysis. As a result of the latter, and also owing to the oxidation of the aldehyde, the liquid becomes acid. The Pharmacopœia gives tests to show a 'limit of acid' and a 'limit of aldehyde.'

When added to about 10 volumes of water, about 50 per cent. of the ethyl nitrite almost immediately escapes, owing to its volatility and insolubility in water. The remainder either gradually escapes or is converted to nitrous acid, which also escapes or is destroyed.

*Dose.*—20 to 40 minims for repeated administration ; 60 to 90 minims for a single administration.

*Pharmacology.*—Its local action is almost solely that of alcohol ; its general action is mainly that of a nitrite. If 60 to 90 minims are added to water and immediately swallowed there is the characteristic taste and alcohol-like action in the mouth and stomach. Absorption quickly occurs, and in five minutes the pulse is somewhat more rapid, slightly fuller, and more compressible. This action increases for 15 to 30 minutes and then commences to return to normal. The normal condition is reached in  $1\frac{1}{2}$  to 2 hours after the administration. The effect is due to dilatation of the blood-vessels, especially the smaller arterioles. The quantity of urine and sweat excreted are slightly increased. The action of the other ingredients is practically negligible.

This preparation is used mainly as a diaphoretic and diuretic after a chill, in chronic Bright's disease, in cardiac disease, and other conditions. It sometimes relieves asthma, and may be used in place of other nitrites as a vaso-dilator.



It should be prescribed pure, with directions to dilute it just before administration.

#### SOLUTION OF ETHYL NITRITE

**Liquor Ethyl Nitritis.**—An alcoholic solution containing, when freshly made, 3 per cent., and never less than  $2\frac{1}{2}$  per cent. by weight of ethyl nitrite.

The solvent is absolute alcohol, 95 vols.; glycerin, 5 vols. The ethyl nitrite is prepared by adding slowly a cooled solution of sodium nitrite to a cooled mixture of alcohol, sulphuric acid, and water, separating the upper ethereal layer, and drying by means of calcium chloride.

*Characters.*—A colourless mobile liquid with a characteristic apple-like odour and a characteristic taste.

Specific gravity. 0.823 to 0.826. It should contain no acid or aldehyde, and should be kept in small blue- or amber-coloured bottles in a cool, dark place.

*Dose.*—20 to 60 minims.

*Pharmacology.*—Its action is very similar to that of Spiritus Ætheris Nitrosi. It contains somewhat more ethyl nitrite and is slightly more powerful. It was introduced as a more stable preparation than sweet spirit of nitre. It is a more reliable vaso-dilator, but it does not appear to have replaced the older preparation. It is used mainly to dilate the blood-vessels in cases of cardiac pain, and as a remedy in asthmatical attacks. It should only be diluted with water just previous to administration.

#### AMYL NITRITE

**Amyl Nitris.**—Consists chiefly of iso-amyl nitrite,  $C_5H_{11}ONO$ , but contains small quantities of other amyl nitrites, butyl nitrites, and propyl nitrites.

Prepared by adding a strong aqueous solution of sodium nitrite to a mixture of amyl alcohol (which has been distilled between  $128^\circ$  and  $132^\circ C.$ ) and sulphuric acid; washing, drying, and re-distilling.

*Characters.*—A yellowish mobile volatile liquid with a pineapple-like odour. Almost insoluble in water, but partially decomposing in it; miscible in all proportions with alcohol.

Specific gravity, 0·870 to 0·880. It should have not more than the faintest acid reaction, and should contain no water and only traces of aldehyde. When distilled, 70 per cent. should pass over between 90° and 100°C. It gives the reactions of nitrites. The amyl radical can be detected by adding the substance, drop by drop, to fused potassium hydroxide, when potassium iso-valerianate is formed, which, on acidifying, gives the characteristic smell of iso-valerianic acid. Amyl nitrite deteriorates unless kept in well-stoppered bottles.

*Dose for inhalation.*—The vapour of 2 to 5 minims.

*Pharmacology.*—After inhaling an ordinary dose, palpitation, throbbing of the carotid arteries, and a feeling of fulness in the head quickly follow; somewhat later, a well-marked blush suffuses the face, and there is often slight mental confusion. The pulse is very rapid, but there are usually no other important symptoms. These effects are due to dilatation of the blood-vessels, more particularly the arterioles. After inhaling the drug they markedly dilate in ten to fifteen seconds and remain well dilated for two minutes or more, after which they return, rapidly at first, then more slowly, to the normal condition. Headache is a common after-effect. Prolonged inhalation may lead to slight cyanosis, laboured respiration, and loss of consciousness; but these symptoms are rarely seen.

It is used mainly to dilate the blood-vessels in cases of angina pectoris. It is sometimes useful in spasmodic asthma, in chloroform syncope, and in deep-seated hæmorrhages. It has been employed in many other diseases—neuralgia, epilepsy, colic, &c.—but is of doubtful value.

## NITROGLYCERIN

**Nitroglycerin** is official in the form of a solution and a tablet. In the pure state it is a syrupy liquid, violently explosive if rapidly heated or struck, and even undergoing spontaneous explosion unless kept with care.

It is prepared by dropping glycerin into a well-cooled mixture of strong nitric and sulphuric acids, and afterwards throwing the mixture into a large volume of cold water. The oily product separating out is washed until free from acid.

Although pharmacologically allied to the nitrites, chemically it is a nitrate (glyceryl trinitrate) and has the formula  $C_3H_5(NO_3)_3$ . It is, however, readily reduced to a nitrite by heating with alkaline solutions.

**Liquor Trinitrini.**<sup>1</sup>—Solution of nitroglycerin. A solution of 1 gramme of nitroglycerin in 100 c.c. of alcohol (90 per cent.).

*Characters.*—Similar in appearance, odour, and taste to alcohol. Miscible with an equal volume of water, but the further addition of water precipitates the nitroglycerin, which is not completely redissolved until about 800 volumes of water have been added. It should be neutral to test-paper.

A solution in water gives no reaction with starch paste and potassium iodide; but if made alkaline, raised to the boiling-point, cooled, and acidified, the addition of starch paste and solution of potassium iodide produces a deep-blue colour.

*Dose.*— $\frac{1}{2}$  to 2 minims.

**Tabellæ Trinitrini.**—‘Tablets of chocolate each weighing 5 grains and containing  $\frac{1}{100}$  grain of the trinitro-glycerin of commerce.’

*Dose.*—1 or 2 tablets.

*Pharmacology.*—The action of the two preparations is practically the same; the tablet acts somewhat more slowly than the solution. After 2 minims of the liquor the same symptoms are experienced as after the inhalation of amyl nitrite, but they appear later (2 to 5 minutes) and are less severe. If the effect on the pulse is followed, it will be found to fall in tension (become more easily compressible) in about  $1\frac{1}{2}$  minutes, and to continue to fall for 3 to 5 minutes longer, after which it is comparatively stationary for 10 to 20

<sup>1</sup> The name is compounded from the first and last syllables of trinitro-glycerin.

minutes, and then gradually returns to the normal, which is reached after  $1\frac{1}{2}$  to 2 hours. Headache is very common after the use of nitroglycerin preparations.

Although nitroglycerin has a similar action on the blood-vessels to the nitrites, it does not produce methæmoglobin so readily as the nitrites when added to blood.

It is used to prevent and relieve the attacks of angina pectoris and other forms of cardiac pain. It acts simply by dilating the blood-vessels and thus relieving the heart, and, like other vaso-dilators, it often fails. It is used to relieve the symptoms produced by a 'high tension' pulse (arteriosclerosis). It is also useful sometimes in relieving mild asthmatical attacks. It has been employed in epilepsy, neuralgia, headache, and other conditions, but is of questionable value.

#### GLYCERIN

**Glycerinum**—glycerol. 'A trihydric alcohol,  $C_3H_5(OH)_3$ , associated with a small percentage of water.'

Prepared by hydrolysing fats or fixed oils by means of alkalis or superheated steam. It is obtained as a by-product in the manufacture of soap and candles.

*Characters*.—A clear colourless syrupy and hygroscopic liquid, without odour, but with a characteristic sweet taste. Miscible with water and alcohol; insoluble in ether, chloroform, and fixed oils. Its solutions are neutral. It is a useful solvent for many substances.

When heated, it decomposes and gives off the irritating vapour of acrolein. It should contain no grape or cane sugar, no butyric acid, or other impurity.

*Dose*.—1 to 2 fluid drachms.

*Pharmacology*.—Applied to excoriated surfaces, pure glycerin produces smarting pain, mainly owing to the abstraction of water from the tissues. On the intact skin it has little action; it acts chiefly as an emollient by protecting and softening it. It is slightly antiseptic. When taken by the mouth it has a sweet taste and acts as a protective to the



buccal and pharyngeal mucous membranes, but in ordinary doses has no further evident effect. (It is poisonous to animals.) It is absorbed and undergoes decomposition in the body, but cannot be regarded as a food in the ordinary sense of the word. If a small quantity (one drachm) is injected into the rectum it causes the passage of a motion a short time afterwards. This is a reflex effect due to the irritant action of the glycerin on the rectal mucous membrane.

It is used externally (diluted with one to three volumes of water) as a remedy for chapped hands, dryness of the skin, &c., and, usually combined with other remedies, in various forms of skin disease. It is largely employed in irritation of the fauces and pharynx, alone or with other remedies, in the form of a mixture, lozenge, or paint. And it is frequently used as an enema to induce purgation. As it produces irritation of the rectum, it should not be given if hæmorrhoids, fissure, &c., are present.

**Glycerina.**—Nine in number. See page 25.

**Suppositoria Glycerini.**—Suppositories containing 70 per cent. of glycerin and usually weighing 30, 60, or 120 grains. They have a gelatin basis.

*Characters.*—The suppositories have a translucent appearance and the consistence of a firm jelly. They are hygroscopic, and consequently must be kept in closed vessels.

*Pharmacology.*—When inserted into the rectum they cause slight irritation, and, as a consequence, purgation. They are used solely in the treatment of occasional constipation.

## CANE SUGAR

**Saccharum Purificatum**—sucrose.  $C_{12}H_{22}O_{11}$ .

Officially described as 'obtained from the juice of the sugar-cane.' It is also obtained from the sugar beet and other plants.

*Characters.*—Colourless transparent crystals with a characteristic sweet taste. Soluble in less than half its

weight of water; very slightly soluble in alcohol; insoluble in ether.

It should not contain glucose, calcium, chlorides, or sulphates. It is converted on inversion into equal amounts of dextrose and levulose.

*Pharmacology*.—It has little action on the skin unless long applied, when it produces irritation. Thus men constantly handling sugar sometimes suffer from a severe form of dermatitis ('grocer's itch'). Taken by the mouth it has the well-known sweet taste, is readily absorbed from the intestines, and is broken up in the body. It is an easily assimilable and very valuable form of food. It is used in therapeutics mainly as a sweetening agent, and in the form of lozenges as a demulcent.

It is a constituent of a large number of the preparations of the Pharmacopœia—syrups, lozenges, confections, mixtures, liquors, pills, powders. In some it acts the part of a preservative; in others it aids solution of some other ingredient.

**Syrupus**.—Consists of sugar 1; boiling distilled water to make  $1\frac{1}{2}$ , by weight.

It is used mainly as a sweetening agent.

#### MILK SUGAR

**Saccharum Lactis**—lactose. 'A crystallised sugar,  $C_{12}H_{22}O_{11}, H_2O$ , obtained from the whey of milk.'

*Characters*.—Hard white or greyish-white crystals or crystalline masses, with a slightly sweet taste. Soluble in 6 parts of water; very slightly soluble in alcohol.

It should not contain more than very small quantities of lactic acid or mineral ash. On inverting, it is converted into dextrose and galactose.

*Pharmacology*.—It is only slightly sweet and is not fermentable, but it acts as a food like other sugars. It is used in modifying cow's milk for the use of infants, and has been employed as a mild diuretic in Bright's disease. It is used mainly as a diluent for powders because its particles do not tend to cohere and it is innocuous. It is also employed to dilute some of the official extracts.

## COMPOUNDS OF THE AROMATIC SERIES

THE lower members of the aromatic group have certain common pharmacological actions. They are antiseptic, antipyretic, and analgesic (pain relieving). These actions are not interdependent. One substance is more antiseptic and less antipyretic or analgesic than another, but all these actions are present in greater or less degree.

## BENZOL

**Benzol.**—‘A mixture of homologous hydrocarbons obtained from light coal-tar oil. It contains about 70 per cent. of benzene,  $C_6H_6$ , and 20 to 30 per cent. of toluene,  $C_6H_5CH_3$ .’

*Characters.*—A colourless, mobile, and volatile liquid, with a strong characteristic odour. About 90 per cent. distils below  $100^\circ C.$ , and hence it is known commercially as 90 per cent. benzol. The whole should distil below  $120^\circ C.$  Specific gravity, 0.880 to 0.888.

Used as a solvent. It has been employed medicinally, but is not to be recommended.

## CARBOLIC ACID

**Acidum Carbolicum**—phenol.  $C_6H_5OH$ .

Prepared from the coal-tar oil distilling between  $170^\circ$  and  $230^\circ C.$  by repeated fractional distillation and treatment with caustic soda solution and sulphuric acid; and in other ways.

*Characters.*—Small colourless deliquescent crystals with a characteristic odour and sweetish, burning taste. When exposed to the air it acquires a pinkish tinge. Soluble in 12 parts of water, in less than its own weight of alcohol, ether, chloroform, or glycerin, and freely in fixed and volatile oils. It also readily dissolves in solutions of caustic alkalies, forming carbolates. It is liquefied by the addition of 10 per cent. of water, and shows no turbidity until 30 to 40 per cent. of water has been added. It has a very faint acid reaction. With camphor it forms a liquid mixture.

Melting-point,  $42^\circ C.$  Boiling-point,  $182^\circ C.$  Its solutions give with dilute solution of ferric chloride a reddish-purple colour; with bromine water a white precipitate of tribromo-phenol. If to an aqueous solution

about one-quarter its volume of solution of ammonia is added, and then a few drops of a solution of chlorinated soda or lime, and the mixture gently warmed, a light-blue colour results. Liquefied carbolic acid coagulates solutions of albumen and of collodion.

Crude phenol contains cresol,  $C_6H_4(CH_3)OH$ , and other homologues. These are less soluble in water than phenol, and, if present, modify its melting- and boiling-points. The Pharmacopœia says that it should not melt below  $38.8^{\circ}C.$ , and its boiling-point should not be above  $182^{\circ}C.$ ; a solubility test to prove the absence of cresol is also given.

In commerce several varieties of so-called carbolic acid occur. They are distinguished as No. 1, 2, 3, 4, and 5. No. 1 is nearly pure phenol; No. 4 is a mixture of about 10 per cent. phenol and 90 per cent. cresols.

*Dose.*—1 to 3 grains.

*Pharmacology.*—In the pure form it is caustic, owing mainly to its power of precipitating albuminous substances. Its caustic action is superficial and well defined. When applied to the skin or mucous membranes it produces a white patch which looks almost as if done by white paint. There is transient burning pain quickly followed by anæsthesia which lasts for some time. After it has disappeared there is distinct soreness on account of the inflammatory reaction beneath. Saturated aqueous solutions are not caustic, but are transiently irritating to susceptible surfaces. If repeatedly applied they cause shrivelling of the skin, which may result in gangrene. Weak solutions (1 per cent.) are sedative.

Carbolic acid is a useful but not a powerful disinfectant. Five per cent. solutions kill fully-developed bacilli, but do not kill all forms of spores even after prolonged contact.

Taken by the mouth in solution it has a sweet characteristic taste and acts as a mild antiseptic and sedative in the mouth and stomach. Taken in the pure form in large quantity it produces first the symptoms of corrosive poisoning, but later, after absorption has occurred, delirium or more usually coma.

Absorption occurs fairly rapidly, both from the alimentary canal and from open wounds. In the blood the greater part of the carbolic acid combines with sulphates and is excreted in the urine as phenol-sulphuric ester. A smaller part is converted into hydroquinone and pyrocatechin, which are also excreted as sulphuric esters; but, on standing, these decompose



and undergo further oxidation, with the result that, after large quantities of carbolic acid have been taken, the urine, on standing, becomes olive-green and finally almost black.

Carbolic acid is used mainly as an antiseptic, a sedative, and a caustic. As an antiseptic it is employed in wound treatment. It is also used for disinfecting instruments, fæces, utensils, &c. As a sedative it is employed in weak solution to relieve itching and irritation. In the pure form it is useful for relieving the pain of a hollow aching tooth. As a caustic it is rarely employed, but is sometimes useful in the treatment of lupus, infective ulcers, and other cutaneous diseases.

As an inhalation it is beneficial in putrid bronchitis and gangrene of the lungs, but creosote is usually preferred.

It has been given by the mouth in a number of diseases, but is of comparatively little value. It exerts a mild antiseptic and sedative action in the stomach and has been used for this purpose, but it becomes too dilute to be of much value as a gastric or intestinal antiseptic.

**Acidum Carbolicum Liquefactum.**—Consists of phenol 10, distilled water 1, by weight.

*Characters.*—A colourless or somewhat pinkish liquid, becoming still redder by keeping. It has the odour and taste of carbolic acid.

Specific gravity, 1·064 to 1·069 at 15·5°C. It should form a clear solution with 20 to 25 per cent. of water.

*Dose.*—1 to 3 minims.

*Pharmacology.*—Same as pure phenol. Being liquefied it is more convenient to use.

**Glycerinum Acidi Carbolic.**—Consists of phenol 1 oz., glycerin to produce 5 fl. oz.

*Pharmacology.*—It has the action of a strong solution of phenol. The glycerin, by preventing the whole of the phenol coming into contact with the tissues, diminishes and prolongs its action, and it is therefore weaker than might be expected from a solution of this strength.

It is used to paint on putrid inflammatory conditions of mucous membranes (mouth, throat, &c.), sometimes as

an application to ringworm and other infective skin diseases, and commonly as a convenient preparation for making lotions, gargles, &c.

**Suppositoria Acidi Carbolici.**—Each suppository contains 1 grain of phenol.

Phenol, 1 gr.; white beeswax, 2 gr.; oil of theobroma, 12 or 13 gr. in each. The beeswax is necessary to give it proper consistence.

*Pharmacology.*—A mild antiseptic and sedative suppository. Useful in painful conditions of the lower part of the rectum (anal fissure, &c.).

**Trochiscus Acidi Carbolici.**—Each lozenge contains 1 grain of phenol. Tolu basis.

*Pharmacology.*—Sedative and mildly antiseptic to the buccal and pharyngeal mucous membranes. The official lozenges are too strong to be readily taken by most people, consequently a lozenge containing  $\frac{1}{3}$  grain of phenol is more commonly used. They are employed in ulcerated conditions of the mouth and throat.

**Unguentum Acidi Carbolici.**—Contains 1 in 25 by weight of phenol.

Phenol, 1; glycerin, 3; white paraffin ointment, 21. The glycerin is used to dissolve the phenol. The ointment tends to become granular by keeping.

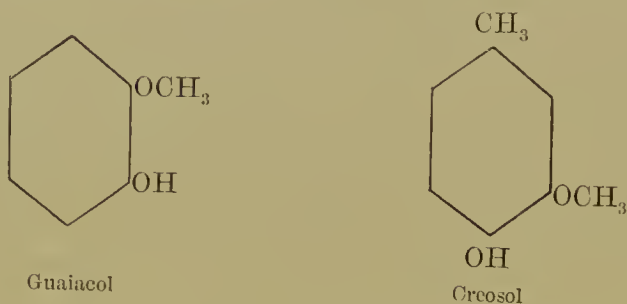
*Pharmacology.*—A sedative and mildly antiseptic ointment. It produces distinct irritation at first and is consequently too strong for some purposes. In these cases it may be diluted two to four times. It is used to apply to infected ulcers, parasitic skin diseases, &c., and diluted, as a sedative ointment, in painful ulcerations and irritable skin diseases.

## CREOSOTE

**Creosotum.**—‘A mixture of guaiacol, creosol, and other phenols; obtained in the distillation of wood tar.’

Besides guaiacol and creosol, the following substances have been isolated: phenol; *p*-cresol; phlorol,  $C_6H_3(CH_3)_2OH$ ; pyrogallol dimethyl ether,  $C_6H_3(OCH_3)_2 \cdot OH$ ; methyl pyrogallol dimethyl ether,  $C_6H_2(CH_3)(OCH_3)_2OH$ ; propyl pyrogallol dimethyl ether,  $C_6H_2(C_3H_7)(OCH_3)_2OH$ ; but for the most part only in small quantities.

Both guaiacol and creosol (not cresol) are methoxy- derivatives.



Guaiacol is a colourless liquid, boiling at  $200^{\circ}C$ . It is soluble in 80 parts of water, freely in alcohol, ether, glycerin, or fixed oils.

Creosol is also a colourless liquid, boiling at  $220^{\circ}C$ . It is soluble in 150 parts of water, readily in alcohol or ether, but not in glycerin.

Different varieties of creosote contain varying quantities of guaiacol and creosol. In some (Rhenish beechwood creosote) guaiacol preponderates, in others (creosote from Stockholm tar) creosol.

*Characters.*—A colourless or yellowish oily liquid, with a characteristic empyreumatic odour and a burning characteristic taste. Soluble in about 150 parts of water; freely soluble in alcohol, ether, chloroform, or glacial acetic acid; miscible with 3 parts or less of glycerin; with more glycerin it forms a turbid solution. Its aqueous solution is neutral or very faintly acid.

Specific gravity, not below 1.079. It should distil between  $200^{\circ}$  and  $220^{\circ}C$ . Some samples rotate the plane of a ray of polarised light to the left, others slightly to the right, some not at all. A dilute solution of ferric chloride added to an aqueous solution gives a greenish coloration which changes to a reddish-brown. It does not gelatinise a solution of collodion. These two tests distinguish it from liquefied carbolic acid, with which it is liable to be confounded. The odour, the miscibility with water and with glycerin, and the boiling-points are also different in the two cases.

*Dose.*—1 to 5 minims.

*Pharmacology.*—Its action is very similar to that of phenol. It is less soluble in aqueous media and does not

precipitate albuminous substances ; it is therefore not caustic in the same sense. Consequently its action in a pure form on the skin and mucous membranes is less marked. It is also less rapidly absorbed.

Applied to the skin it quickly produces slight burning pain followed by slight numbness ; applied to mucous membranes its action is the same, but the burning pain is much more marked. It is said to be somewhat more antiseptic than phenol.

Taken by the mouth in aqueous solution it has a characteristic taste, and, in small doses, produces a stimulant and carminative effect on the stomach and intestines. It is absorbed, and its further action is similar to that of phenol. It appears, however, to exert a more marked action, resembling more closely that of a volatile oil, on the bronchial mucous membrane, and to have a less marked action on the nervous system.

It has been used externally, as an ointment or lotion, in parasitic skin diseases and also to relieve itching. It is often applied to a hollow aching tooth, but is less efficient than carbolic acid. As an inhalation it is useful in fetid bronchitis, pulmonary gangrene, and phthisis, and is generally preferred to carbolic acid. It is given internally as a gastric and intestinal carminative and antiseptic in flatulence and diarrhoea with fetid stools and as a remedy for phthisis. The beneficial influence it exerts in this disease is indirect, and is due mainly to its stimulating influence on the alimentary system. The quantity existing in the blood after ordinary doses have been given is insufficient to exert any injurious effect on the tubercle bacilli at the seat of the disease. It is given in small doses at first, which are gradually increased.

**Mistura Creosoti.**—An almost colourless aqueous solution containing creosote 1 minim ; spirit of juniper 1 minim ; a little syrup (30 minims) in 1 fluid ounce.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—It has the characteristic taste of creosote solutions, and acts as a stimulant and carminative



in the stomach. Many people find it unpleasant to take, and consequently creosote is more commonly given dissolved in oils (cod-liver oil, &c.) as an emulsion, or in pills or capsules.

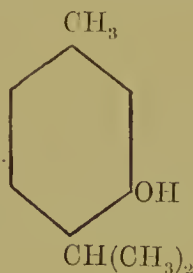
**Unguentum Creosoti.**—Contains 1 in 10 by weight of creosote.

Creosote, 1; hard paraffin, 4; white soft paraffin, 5.

*Pharmacology.*—It is mildly antiseptic, irritating at first, then somewhat sedative. It is used in parasitic skin diseases and to relieve the itching of chronic skin diseases.

### THYMOL

**Thymol.**—Para-isopropyl-meta-cresol.



Obtained from the volatile oils of *Thymus vulgaris*, *Linn.*, *Monarda punctata*, *Linn.*, and *Carum copticum*. *Benth. and Hook.*, and other volatile oils.

*Characters.*—Large translucent crystals, with an agreeable thyme-like odour, and a hot, bitter, somewhat aromatic taste. Soluble in about 1,000 parts of water, in less than its weight of alcohol, ether, or chloroform, and in two parts of olive oil.

Being a phenol it is soluble in solutions of caustic alkalies. Melting-point, 50° to 51·5° (but may be as low as 44°C.). Boiling-point, 231° to 232°C. The crystals, however, volatilise completely at 100°C. A solution in  $\frac{1}{2}$  part of glacial acetic acid, mixed with an equal bulk of strong sulphuric acid and warmed, assumes a reddish-violet colour.

*Dose.*— $\frac{1}{2}$  to 2 grains.

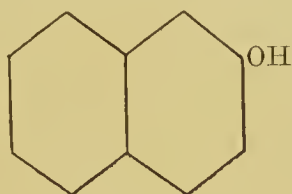
*Pharmacology.*—Similar to that of phenol, but much less active on account of its insolubility. In solutions of the same strength it is a more powerful antiseptic than phenol. It has

a mild carminative and antiseptic action in the stomach and intestines, and has been given as an intestinal antiseptic in typhoid and other forms of diarrhoea. In large doses (10 to 60 grains), it has been employed in the treatment of tape-worm and anchylostoma; but ill-effects (vomiting, colic, transient albuminuria, and even symptoms of collapse) have followed its use in these doses.

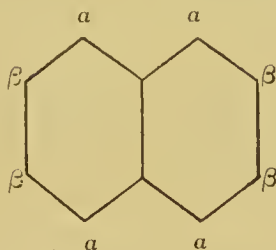
It is a valuable deodorant. It is also useful as a mouth-wash, and as an ointment in chronic and parasitic skin diseases. It is employed sometimes as an inhalation in bronchial troubles.

## BETA-NAPHTHOL

$\beta$ -**Naphthol**—beta-mono-hydroxy-naphthalene.



The positions in the naphthalene ring are  $\alpha$  and  $\beta$ . They are as follows:



The hydroxyl group in the official naphthol is in the  $\beta$  position, and hence is beta-naphthol.

Prepared from naphthalene by heating it with sulphuric acid to about  $180^{\circ}\text{C}$ . to form naphthalene sulphonic acid. The mixture is treated with slaked lime to eliminate excess of sulphuric acid, and the filtered liquor is evaporated to a pasty consistence and pressed to separate the more soluble  $\alpha$ -variety which is present. The washed residue is converted by means of sodium carbonate into the sodium salt, and this is subsequently added to fused caustic soda, and the fused mass decomposed by hydrochloric acid. The  $\beta$ -naphthol thus obtained is purified by sublimation or crystallisation.

*Characters.*—Small white or slightly brownish crystalline laminae, somewhat unctuous to the touch, with a slight phenol-like odour, and a hot bitter taste. Soluble in about 1,000 parts of water, in less than 2 parts of alcohol or ether, in 12 parts of olive oil, and in about 40 parts of glycerin.

It dissolves in solutions of caustic alkalies, forming naphtholates. Melting-point, 122°C. The addition of a drop of solution of ammonia to a hot saturated solution produces a blue fluorescence. Chlorine water added to a cold saturated solution produces a white turbidity which, on the addition of excess of solution of ammonia, is converted into a green colour.

It should contain no *a*-naphthol or mineral impurity.

*Dose.*—3 to 10 grains.

*Pharmacology.*—Its action is comparable to phenol, but as it is very much less soluble it has a much weaker action. In solutions of the same strength, naphthol is a more powerful antiseptic than phenol. Applied to mucous membranes or denuded surfaces it is somewhat irritant. When taken by the mouth it tends to retard abnormal fermentations in the alimentary canal, and is consequently regarded as a gastric and intestinal antiseptic. It is absorbed, and if given in large doses may produce toxic symptoms, more particularly nephritis (albuminuria, hæmoglobinuria).

It is used mainly in the treatment of chronic skin diseases, usually in the form of about 10 per cent. ointment. It has been given as an intestinal antiseptic in typhoid fever, cholera, &c., but is of little value.

## BENZOIC ACID

### **Acidum Benzoicum**— $C_6H_5 \cdot COOH$ .

Prepared from benzoin by sublimation, or by boiling it with milk of lime and decomposing the calcium benzoate formed by means of hydrochloric acid; or from toluene; or from hippuric acid.

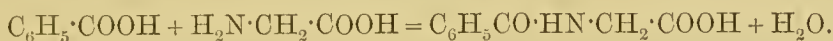
*Characters.*—Light shining feathery or acicular crystals, colourless and odourless, when pure, but when prepared from benzoin usually possessing a slight fragrant benzoin-like odour (prepared from hippuric acid it has often an unpleasant

odour), with a sweet, afterwards somewhat acrid taste. Soluble in 400 parts of water, in 1 part of absolute alcohol, in 3 parts of ether, in 7 of chloroform, in 30 of glycerin, and in fixed and volatile oils. It dissolves readily in alkaline solutions, forming benzoates. It volatilises in the vapour of water.

Melting-point,  $121.4^{\circ}\text{C}.$ , boiling-point,  $249^{\circ}\text{C}.$ , when pure. The commercial acid melts at about  $120^{\circ}\text{C}.$  and boils at about  $239^{\circ}\text{C}.$  It should not contain hippuric acid, chloro-benzoic acid, cinnamic acid, or oxalates. Cinnamic acid is liable to be present if the benzoic acid is prepared from Sumatra benzoin; hippuric acid, if it is prepared from this substance; chloro-benzoic acid, if impure benzyl chloride has been used in the preparation of benzoic acid from toluene.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It is a moderately powerful antiseptic, and in the pure form is somewhat irritant to mucous membranes. Thus, if sniffed, it produces sneezing. It is, however, generally well borne by the stomach, is absorbed as benzoates, and in ordinary doses rarely produces any obvious symptoms. In febrile patients it may cause a slight fall of temperature. It is excreted mainly by the kidney, to a slight extent by the skin, the bronchial mucous membrane, and the salivary secretion. In its course through the kidney it combines with glycocoll (amido-acetic acid) and is excreted in the urine as hippuric acid or hippurates.



It tends to diminish the alkalinity and putridity of the urine, when present, and for this purpose is given in cystitis and other genito-urinary diseases. It also stimulates the bronchial mucous membrane if this is relaxed, and it is sometimes used as an expectorant, usually in the form of the balsams (which owe much of their action to benzoic acid) or the tinctures (paregorics) mentioned below. It is used sometimes as an antiseptic lotion.

**Trochiscus Acidi Benzoici.**—Each lozenge contains  $\frac{1}{2}$  grain of benzoic acid. Fruit basis.

*Pharmacology.*—Used as a mild stimulant and antiseptic in pharyngeal affections.



**Tinctura Camphoræ Composita** (see page 315).

**Tinctura Opii Ammoniata** (see page 315).

**Sodii Benzoas**— $C_6H_5 \cdot COONa$ .

Prepared by neutralising a solution of sodium carbonate with benzoic acid, crystallising, or evaporating to dryness.

*Characters.*—A white amorphous or crystalline powder, often granulated, inodorous or with a faint benzoin odour, and having an unpleasant sweetish saline taste. Soluble in less than 2 parts of water, and in 25 parts of alcohol. Its aqueous solution is faintly alkaline.

Moderately strong aqueous solutions precipitate benzoic acid when acidified. It should contain not more than traces of chlorides or sulphates, and no carbonates or mineral impurity. The official quantitative test indicates an average purity of 98 per cent. of pure sodium benzoate. The remainder should be water.

*Dose.*—5 to 30 grains.

*Pharmacology.*—It is less irritating and less antiseptic than benzoic acid, but after absorption it exerts the same action and undergoes the same synthesis to hippuric acid during excretion. It is the salt generally used when a benzoate action is required. It is given in cystitis, in gonorrhœa, and in phosphaturia. It has been used as an antipyretic, as a hepatic stimulant, and for other purposes, but is of no practical value.

**Ammonii Benzoas**— $C_6H_5 \cdot COO(NH_4)$ .

Prepared by neutralising solution of ammonia with benzoic acid, and crystallising.

*Characters.*—Small colourless lamellar crystals, usually with a slight benzoin odour, and having a saline, somewhat sweetish, taste. Soluble in less than 6 parts of water, in 30 parts of alcohol, and in 8 parts of glycerin.

It loses ammonia to a slight extent on exposure to air. If its aqueous solutions are boiled, ammonia is slowly given off, and the liquid becomes acid. A moderately strong aqueous solution when acidified deposits benzoic acid.

*Dose.*—5 to 15 grains.

*Pharmacology.*—Its action is similar to that of sodium benzoate. The sole difference is that due to the difference of the basic radicals (see page 122). It is used for the same purposes as sodium benzoate, and is also given in chronic bronchitis, and in gout and allied conditions.

### SALICYLIC ACID AND ALLIED SUBSTANCES

**Acidum Salicylicum**—ortho-oxybenzoic acid,  
 $C_6H_4 \cdot OH \cdot COOH$ .

Prepared by heating sodium carbolate (sodium phenoxide) in a current of dry carbon dioxide, under certain conditions of temperature and pressure; also by saponifying the oils of wintergreen and sweet birch, which consist almost wholly of methyl salicylate, decomposing the alkali salicylate formed in each case with an acid, and crystallising. The acid obtained by the latter method is known as 'natural salicylic acid'; that obtained by the former method as 'artificial salicylic acid.' A specially purified variety of the latter is called 'physiologically pure.'

*Characters.* — Colourless prismatic crystals, without odour, but with a sweetish, acid, and afterwards acrid taste. Soluble in 500 parts of water, in 3 parts of alcohol, in 2 parts of ether, and in 200 parts of glycerin; readily soluble in solutions of alkalies or alkaline salts, forming salicylates. Thus it dissolves in solutions of borax, sodium phosphate, ammonium citrate and ammonium acetate.

Melting-point,  $156^{\circ}$  to  $157^{\circ}C$ . If carefully heated, it can be volatilised. A weak solution of ferric chloride added to an aqueous solution gives a violet colour, or, if the solution is dilute, a reddish-violet colour. Bromine water added to a solution forms a slightly yellow precipitate. A solution of uranium nitrate, when added to a solution of a salicylate not weaker than 1 per cent., gives a yellowish-brown precipitate of uranium salicylate. (No precipitate is obtained with carbolates or sulpho-carbolates.) It should contain no iron, phenol, colouring matter, or other impurity.

Natural salicylic acid usually occurs in large crystals with a yellowish or pinkish hue.

*Dose.*—5 to 20 grains.

*Pharmacology.*—It is somewhat more antiseptic than phenol, but less irritating to tissues, both on account of its smaller solubility in aqueous media and its smaller diffusibility. If sniffed, it produces severe sneezing. Saturated aqueous

solutions applied to the skin produce no obvious effect, but if a strong ethereal solution is applied, it gradually kills the superficial epidermis without producing any distinct inflammatory reaction underneath, and after twenty-four hours or so the dead skin can be peeled off as a white layer. In intermediate strengths it is stimulant and aids the growth of epidermis where deficient.

When taken by the mouth it has a sweetish acid taste; and after swallowing, a slight acid sensation is felt at the top of the throat. On account of its irritant action it is not well borne by the stomach, and consequently is now rarely given internally. It is absorbed as sodium salicylate, and acts as such (see below), except that it makes the urine more acid.

It is used externally as an antiseptic in wound treatment, parasitic skin diseases, and in the preservation of solutions (and not infrequently beverages and food); to remove epidermal thickenings, as corns, warts, &c., and destroy the tissue of lupus; to stimulate healthy tissue-growth in various forms of superficial chronic skin diseases; to diminish sweating, especially if accompanied by an offensive odour.

**Unguentum Acidi Salicylici.**—Consists of salicylic acid 1; white paraffin ointment 49.

*Pharmacology.* — Useful in various chronic scaly diseases of the skin.

**Sodii Salicylas**— $C_6H_4 \cdot OH \cdot COONa$ .

Prepared by neutralising a solution of sodium carbonate or sodium hydroxide with salicylic acid, and crystallising.

*Characters.*—Colourless pearly scales or tabular crystals, without odour, but with an unpleasant sweetish saline taste. Soluble in less than its weight of water, and in 30 parts of absolute alcohol. Its aqueous solutions are neutral or only faintly acid.

With solution of ferric chloride and solution of uranium nitrate it gives the reactions mentioned under Acidum Salicylicum. It should contain not more than traces of chlorides or sulphates, and no phenol or other impurity.

*Dose.*—10 to 30 grains.

*Pharmacology.*—It is somewhat antiseptic, but is not used externally. When taken by the mouth it has a rather unpleasant sweetish taste, nauseating to some people, but it is well borne by the stomach and is quickly absorbed. After full doses no symptoms are seen or felt in most healthy individuals, except slight diaphoresis and diuresis, but in patients suffering from rheumatic fever the temperature falls and the pain diminishes, and after several doses both pain and temperature may disappear. Experimentally, sodium salicylate has been found to increase the quantity of bile secreted.

During their passage through the kidney, salicylates undergo a similar synthesis to benzoates. They combine with glycocoll, and are excreted mainly as salicyluric acid.

After repeated large doses, or in specially susceptible individuals even after small doses, a form of poisoning known as **salicylism** appears. The symptoms closely resemble those of cinchonism (see page 291). Noises in the ears and deafness are usually the earliest and most prominent symptoms. These may be accompanied by a feeling of fulness in the head or headache, and increased perspiration. Diminution of sight may occur, and, after large doses, delirium and other serious symptoms. These symptoms are said to be due to impurities (cresotinic acids), but they occur after the administration of pure sodium salicylate.

Sodium salicylate is used mainly in the treatment of rheumatic fever. If given in full doses it quickly reduces the temperature and relieves the pain of this disease, but it is necessary to continue the administration, otherwise a relapse is liable to occur. The dose may, however, be gradually reduced. The symptoms of salicylism, except, perhaps, slight noises in the ears, should be avoided. In sub-acute rheumatism, sodium salicylate is much less valuable, and in chronic rheumatism it is of little use. It has been given in a large number of other diseases—so-called muscular rheumatism, chorea, gout, sciatica, influenza, Menière's disease, diabetes, and as an antipyretic in various fevers—but it is a very uncertain remedy. It is, however, often useful in acute tonsillitis,



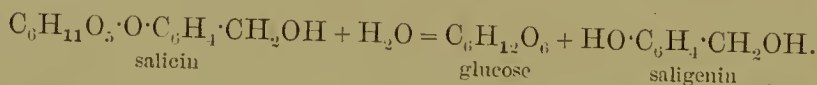
and in certain erythematous skin diseases (erythema multiforme, erythema nodosum) commonly regarded as of rheumatic origin.

**Salicinum.**—‘A crystalline glucoside,



obtainable from the bark of various species of *Salix*, and of *Populus*.’

On boiling with dilute acids it breaks up into glucose and salicylic alcohol (saligenin).



*Characters.*—Colourless acicular or tabular crystals, without odour, but with a very bitter taste. Soluble in 30 parts of water and in 80 parts of alcohol; insoluble in ether.

Melting-point, 198°C. When heated above the melting-point it gives off salicyl aldehyde. If added to a dilute solution of potassium bichromate and sulphuric acid and warmed, salicyl aldehyde, which has the odour of meadow-sweet, is given off. Added to a small quantity of sulphuric acid, it gives a red colour.

*Dose.*—5 to 20 grains.

*Pharmacology.*—When taken by the mouth it has a bitter taste, but has no other action of importance on the alimentary canal. It is largely decomposed in its passage through the body into glucose and salicylic alcohol, part of which is further oxidised to salicylic acid, so that its action is that of salicylates. It is excreted in the urine as salicin, salicylic alcohol, and salicylic acid.

It is useful in acute rheumatism, but is less active than sodium salicylate. It is, however, more pleasant to take than the latter, and may often replace it with advantage after the acute symptoms have subsided.

**Salol**—phenyl salicylate.  $\text{C}_6\text{H}_4 \cdot \text{OH} \cdot \text{COO} \cdot \text{C}_6\text{H}_5$ .

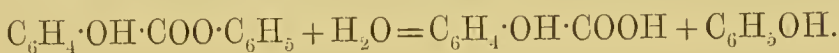
Prepared by fusing a mixture of sodium salicylate and sodium carbonate with phosphorus oxychloride or carbonyl chloride, dissolving out the sodium phosphate and chloride formed by water, and crystallising the residue.

*Characters.*—Small colourless crystals, with a faint characteristic agreeable odour, but almost without taste. Nearly insoluble in water, soluble in 10 parts of alcohol and in less than half its weight of ether or chloroform, readily soluble in fixed and volatile oils.

Melting-point, 42° to 43°C. An alcoholic solution gives a violet coloration with a dilute solution of ferric chloride, and a white precipitate with a few drops of bromine water. If heated with a solution of an alkali it dissolves, being decomposed into a carbolate and salicylate, and the mixture when acidified gives off the odour of phenol and deposits crystals of salicylic acid. It should contain no free salicylic acid and no sulphates or chlorides.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It is slightly antiseptic, but its chief action is due to the fact that it is readily decomposed by alkalies into phenol and a salicylate,



When taken by the mouth it exerts practically no action until it reaches the intestines. Here it is gradually decomposed into phenol and a salicylate, and therefore acts as a slight antiseptic as it passes along the intestinal canal. The phenol and salicylate formed, however, are quickly absorbed, and act in the manner already described. The proportion of phenol and salicylic acid produced by the decomposition is, roughly, as 2 to 3, but the main action, seen especially after large doses, is a phenol action, because this is the more powerful of the two substances.

Salol is used as an ointment (20 to 40 per cent.) in the treatment of parasitic skin diseases, but is of comparatively little value. It is used in weak alcoholic solution as a mouth-wash, and is given internally as an intestinal and urinary antiseptic. It is of no value as an intestinal antiseptic in typhoid fever and cholera, but it appears to retard the putrefactive changes occurring in certain forms of diarrhœa in children. As a urinary antiseptic it is of some use in inflammation of the pelvis of the kidney, the bladder, and the urethra (gonorrhœa, &c.). It will relieve the pain and lower the fever

of acute rheumatism, but is less efficacious and more dangerous than sodium salicylate.

**Bismuthi Salicylas.**—See page 162.

The following three compounds are mainly analgesic and antipyretic. The first two are closely similar in chemical constitution.

#### ACETANILIDE

**Acetanilidum**—Phenyl-acetamide. Antifebrin.  
 $\text{CH}_3\cdot\text{CO}\cdot\text{NH}\cdot\text{C}_6\text{H}_5$ .

Prepared by heating a mixture of glacial acetic acid and aniline for some hours, pouring into water, and recrystallising the precipitate.

*Characters.*—Small colourless glistening crystals, without odour, but with a slight warm taste. Soluble in 210 parts of water and in 4 parts of alcohol, readily soluble in ether and chloroform. Its aqueous solution is neutral.

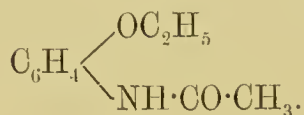
Melting-point, of pure dry substance,  $113\cdot5^\circ\text{C}$ . When heated with a solution of caustic alkali, aniline is formed, which can be detected by the smell, but, better, by adding a few drops of chloroform and warming, when the unpleasant, extremely penetrating odour of phenyl-isonitrile develops. An aqueous solution forms with bromine water a yellowish-white precipitate, but gives no coloration with dilute solution of ferric chloride.

*Dose.*—1 to 3 grains.

*Pharmacology.*—It is slightly antiseptic, but is not used externally. When taken in pharmacopœial doses it usually produces no effect in healthy individuals, but if headache or neuralgic pain is present it frequently relieves this, or if fever exists a fall of temperature results. The latter effect is due mainly to an action on the temperature-regulating mechanism in the brain.

Ill effects have frequently followed the administration of this substance. The more important of these are cyanosis and more or less marked symptoms of collapse. It has been given to reduce temperature in fever, and to relieve headache and neuralgic pain. On account of its toxicity, however, the two following compounds are to be preferred.

## PHENACETIN

**Phenacetinum**—Para-acet-phenetidin,

Prepared by boiling para-phenetidin (obtained from para-nitro-phenol by introducing an ethyl group and reducing the nitro- group) with glacial acetic acid, precipitating with water, and recrystallising.

*Characters*.—Small white, glistening, scaly crystals, without odour or taste. Very slightly soluble in water (about 1 in 1,700), soluble in 20 parts of alcohol.

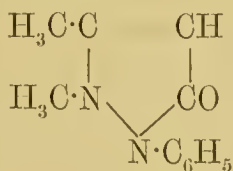
Melting-point of pure, dry substance, 135°C. When boiled with a little diluted nitric acid (10 to 12 per cent.  $\text{HNO}_3$ ), it forms an orange-coloured solution which, if sufficiently concentrated, deposits, on cooling, yellow needles of nitrophenacetin; these melt at 103°C. About 0.1 g. of phenacetin boiled with about 4 c.c. of hydrochloric acid for a few minutes forms a colourless solution, which, when diluted with 10 volumes of water and filtered from any precipitate which may have formed, gives, with a few drops of a solution of chromic acid, a yellowish solution, which gradually changes to a ruby-red. A saturated aqueous solution gives no precipitate with bromine water (compare acetanilide). It should not contain acetanilide or para-phenetidin.

*Dose*.—5 to 10 grains.

*Pharmacology*.—It has a similar action to acetanilide, relieving pain if present and reducing fever by acting on the thermal centres in the brain. It is slower in action than acetanilide, frequently taking nearly an hour to act, but it is a much safer remedy. Ill effects from its use are comparatively rare. It appears to have a slight hypnotic action.

It is used largely to relieve pain, especially headache, neuralgia, and rheumatic pains. It is less valuable as an antipyretic.

## PHENAZONE

**Phenazonum** — antipyrin, phenyl - dimethyl - isopyrazolone.



Prepared by heating phenyl-hydrazine with aceto-acetic ether and afterwards heating the phenyl-methyl-isopyrazolone formed with methyl iodide.

*Characters*.—Colourless scaly crystals, without odour but with a bitter taste. Soluble in less than 2 parts of water, alcohol, or chloroform, and in 40 parts of ether. Its solutions are neutral.

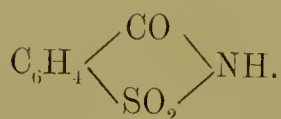
Melting-point, 113°C. If to an aqueous solution a little sodium nitrite is added, and then dilute sulphuric acid, a green colour is obtained owing to the formation of a nitroso-compound. Fuming nitric acid and old sweet spirit of nitre, owing to the free nitrous acid they contain, give the same reaction with antipyrin. If a few grains are dissolved in a few drops of water, and a few drops of fuming nitric acid added, a green colour results, which, if the mixture is heated to boiling and a little more nitric acid added, changes to red. An aqueous solution of antipyrin gives, with a dilute solution of ferric chloride, a deep-red colour, which is changed to a yellowish colour on the addition of excess of dilute sulphuric acid. An aqueous solution gives a white precipitate with solution of tannic acid.

*Dose*.—5 to 20 grains.

*Pharmacology*.—It has a very similar action to the two preceding substances. Being much more soluble in water it acts more quickly, but its action is not so prolonged. Its uses are the same. When locally applied, however, it contracts blood-vessels, and it has been used as a local hæmostatic, but is less valuable than other preparations.

#### GLUSIDE

**Glusidum**—saccharin. Benzoyl sulphonimide.



Prepared from ortho-toluene-sulphonic acid (obtained by the action of sulphuric acid on toluene at a temperature not exceeding 100°C.) by converting it into the sodium salt, treating this with phosphorus pentachloride to obtain *o*-toluene-sulphonic-chloride, converting this by means of ammonia into *o*-toluene-sulphonamide, and oxidising it with potassium permanganate in neutral solution.

*Characters*.—A white micro-crystalline powder, without odour, but with a nauseously sweet taste. Soluble in 360 parts

of water, in 30 parts of alcohol, and in 50 parts of glycerin; slightly soluble in ether or chloroform. It dissolves readily in alkaline solutions.

Melting-point, 220°C. On dissolving in a solution of caustic potash, evaporating to dryness, and fusing for a few minutes, gluside is converted into a salicylate; thus the product, if dissolved in water and neutralised with hydrochloric acid, gives, with dilute solution of ferric chloride, a reddish-brown or purplish colour. It is not charred by sulphuric acid. It should contain no sugar or sulphamido-benzoic acid.

Commercial saccharin (sold as 300 times as sweet as sugar) is a mixture of about equal parts of gluside and sulphamido-benzoic acid.

When gluside is dissolved in solutions of sodium hydroxide, sodium carbonate, or sodium bicarbonate, a sodium compound is formed which, when evaporated to dryness, is known as **soluble saccharin**. It is extremely sweet, and is soluble in about 15 parts of water.

*Pharmacology.*—It has a slight antiseptic action, but its uses are almost confined to those of a sweetening agent. It is 500 times sweeter than cane sugar, and a solution of 1 in 100,000 has a distinct, sweet taste. The taste is, however, somewhat different from that of cane sugar. It is a stable compound, and produces no distinctive symptoms even when given in comparatively large doses. It is excreted in the urine unchanged.

It is used as a sweetening agent, mainly in diabetes.

## ANIMAL AND VEGETABLE SUBSTANCES

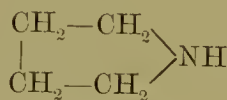
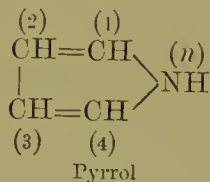
IN this group will be included, besides the crude products of the animal and vegetable kingdoms, the pure chemical substances obtained from these, although they may have been synthesised. Any other arrangement would be inconvenient since the pharmacological action of the crude drug and pure principle is similar if not identical.

The classification of these substances presents some difficulty. For reasons mentioned in the preface a chemical classification has been adopted.

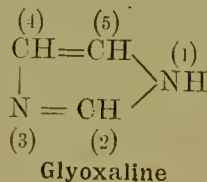
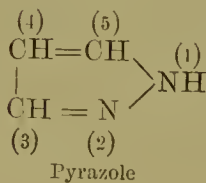
### DRUGS CONTAINING ALKALOIDS AS THE MAIN ACTIVE CONSTITUENTS

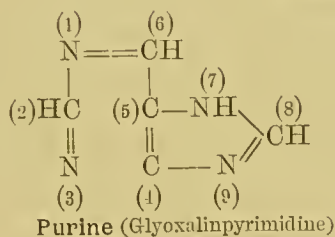
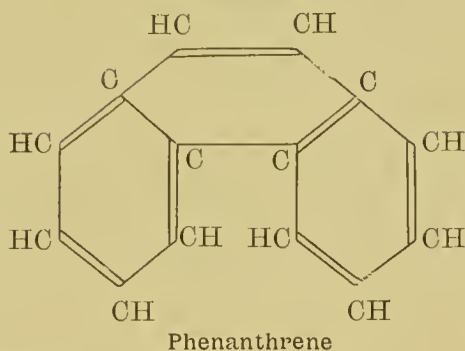
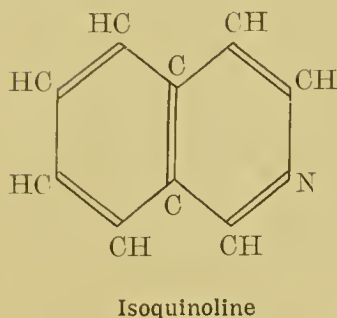
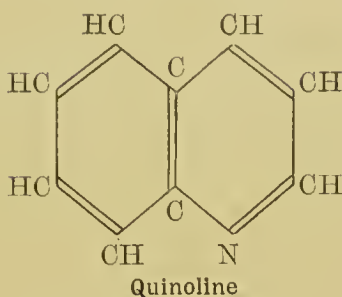
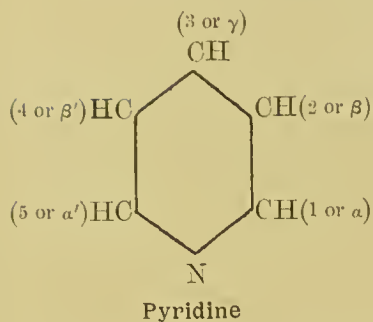
This class includes some of the most important drugs used in medicine.

Alkaloids have been already defined (page 4) as 'nitrogenous vegetable products which have their nitrogen combined in the form of a closed ring.' These rings may be five- or six-membered or more. The following are the more important ones:



Pyrrolidine





The constitution of most of the alkaloids occurring as active principles in official drugs is unknown, or only partially known. According to our present knowledge they may be divided as follows:

**Pyrrolidine derivatives**—the alkaloids of belladonna and its allies; of coca.

**Glyoxaline derivatives**—the alkaloids of jaborandi.

**Pyridine derivatives**—the alkaloids of eonium; of pepper; of pyrethrum; possibly others, *e.g.* of pomegranate, of broom.

**Quinoline or Isoquinoline derivatives**—the alkaloids of cinchona; of nux vomica; some of the less important alkaloids of opium; the alkaloids of hydrastis.

**Phenanthrene derivatives**—the more important alkaloids of opium.

**Purine derivatives**—caffeine.

**Of unknown constitution**—the alkaloids of aconite, of delphinium, of gelsemium, of lobelia, of calabar bean, of ipecacuanha, of colchicum, of pomegranate, of cusparia, of broom, of pereira, of serpentary, and veratrine.

A few other official drugs are said to contain alkaloids, but these are not the active principles of the drug, and consequently do not fall into this group.

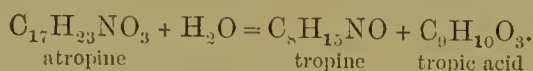


## I. PYRROLIDINE GROUP

This includes the alkaloids in (*a*) belladonna, hyoscyamus, and stramonium; (*b*) coca. The alkaloids of the (*a*) group are very closely allied; those of (*a*) and (*b*) are allied but much less closely.

(*a*) What is sometimes called the belladonna or atropine group of alkaloids includes atropine, hyoscyamine, hyoscyne, scopolamine, and a few unimportant alkaloids—atroscine, atropamine, and belladonnine.

By treatment with alkalies and a few other substances atropine and hyoscyamine can be broken up into a base, tropine, and tropic acid. The process is one of hydrolysis:

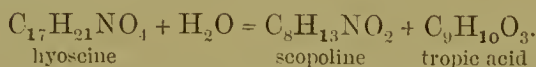


By heating the products with dilute hydrochloric acid on a water-bath the reverse reaction occurs, *i.e.* atropine is formed from tropine and tropic acid.

The relation between atropine and hyoscyamine is apparently simple. Both have the same empyric formula, and both yield the same decomposition products; hence they must be stereo-isomers. But, while atropine has no influence on polarised light, hyoscyamine rotates this to the left. Atropine is therefore believed to be the so-called inactive modification of hyoscyamine.

Hyoscyamine is readily converted (by the action of heat or alkalies) into atropine, and it has therefore been doubted if atropine exists as such in the plant. It does, however, appear to occur naturally in the fruit and in old plants, but by far the greater part of the alkaloids present is undoubtedly hyoscyamine. During the process of extraction this is converted into atropine, so that this alkaloid is the active principle obtained.

Hyoscyne and scopolamine have a somewhat different chemical composition to atropine and hyoscyamine. When hydrolysed they yield scopoline and tropic acid:



Unfortunately, considerable confusion exists regarding these names. According to Continental authorities, the same relation exists between hyoscyne and scopolamine that exists between atropine and hyoscyamine. *i.e.* hyoscyne is inactive scopolamine, scopolamine being lævo-rotatory. The hyoscyne of the Pharmacopœia, however, is what is often termed scopolamine, as is evident from the melting-point of its gold salt.

The other naturally-occurring alkaloids of this group are unimportant.

Atroscine,  $C_{17}H_{21}NO_4$ , hydrolyses like scopolamine; belladonnine and atropamine,  $C_{17}H_{21}NO_2$ , yield on hydrolysis tropine and atropic acid. It has been doubted if they exist naturally in the plants.

On account of the fact that the alkaloids of this group yield tropine and scopoline, they are known as **tropeines** and **scopoleines** respectively. As a group, the tropeines and scopoleines may be defined as compounds (esters) of tropine or scopoline with an organic acid radical. A number of artificial tropeines are known, a salt of one, **Homatropine**, being official in the Pharmacopœia. Homatropine is made by combining tropine with phenyl-glycollic acid (oxy-toluic or mandelic acid), and is therefore phenyl-glycollic tropeine (mandelic tropeine or oxy-toluic tropeine).

The relation between atropine and cocaine is given later (page 273).

Before considering the individual drugs belonging to the belladonna group, it will be convenient to describe briefly the pharmacological action of its chief alkaloids.

*The pharmacological action of atropine, hyoscyamine, and hyoscine.*—The predominant action of these alkaloids is on the nervous system. They all paralyse the terminations of the nerve-endings in involuntary muscular tissue and in secretory glands, and, after larger doses, affect the central nervous system; atropine and hyoscyamine causing excitement and delirium, hyoscine calmness and sleep.

After small doses of **atropine** ( $\frac{1}{200}$  to  $\frac{1}{100}$  grain) there appears in 5 to 15 minutes an increase in the frequency of the pulse, quickly followed by dryness of the mouth and dryness of the skin if this has been previously moist. The pupils may be somewhat dilated, and there may be slight excitement, although this is uncommon.

After larger doses ( $\frac{1}{20}$  to  $\frac{1}{4}$  grain) the pulse becomes very rapid, there is marked dryness of the mouth, with difficulty in moving the tongue, difficulty in swallowing, often nausea, and occasionally vomiting. The skin becomes very dry, and about the head and breast is commonly flushed. The pupils are markedly dilated, the power of accommodation is largely lost, and there is consequently misty and usually double vision. Headache and giddiness, followed by loquaciousness, delirium, and less important symptoms, occur.

After doses of 1 grain, the symptoms are naturally more severe. The pulse is extremely rapid; the mouth and throat

are completely dry ; the skin is hot, flushed, and dry ; the iris can scarcely be seen ; and there is well-marked excitement and delirium. Complete unconsciousness, with failing heart and respiration, may occur later, and may usher in death.

Many of these symptoms are the result of paralysis of the nerve-endings in the different tissues. Thus the increase in the frequency of the pulse is due to paralysis of the vagus endings in the heart ; the dryness of the mouth to paralysis of the nerve-endings in the salivary and buccal glands ; the dilatation of the pupil to paralysis of the terminations of the third cranial nerve in the iris, and the double vision to loss of accommodation owing to paralysis of the terminations of the same nerve in the ciliary muscle. The dryness of the skin is also the result of paralysis of the nerve-endings in the sweat glands, but the flushing of the skin is of central origin.

Besides the secretions named, atropine also affects the nasal and bronchial excretions and, to a much less extent, the gastric and intestinal secretions. The urine is not decidedly affected, mainly because it is but slightly controlled by the nervous system. The unstriped muscle of the bronchi, stomach, intestine, uterus, ureters, bladder, &c., is influenced by atropine, but to a much less extent than the pupil. Thus, when administered in therapeutic doses with purgative medicines, it does not appreciably delay the action of these. It is believed by some physicians to increase the purgative effect. It does, however, diminish or prevent the griping produced by purgatives, and preparations of belladonna are sometimes used for this purpose. A few exceptions to the rule, that atropine paralyses the nerve-endings in all unstriped muscular tissue are known, but they are unimportant.

Atropine has no action on voluntary muscular tissue, and, when given internally, does not influence sensory nerves, although if applied locally it depresses their terminations and acts as a sedative.

The medullary centres are stimulated by small doses of atropine. The most manifest action is on the respiration, and occasionally atropine is used to stimulate the respiratory centre.

The local action of atropine on the eye is of importance.



A very small amount (less than  $\frac{1}{10000}$  grain) will produce dilatation of the pupil. Therapeutically, however, much larger doses are employed. If a drop of a 1 per cent. solution is placed in the eye the pupil begins to dilate in ten to fifteen minutes, and in thirty to thirty-five minutes is completely dilated. Paralysis of accommodation quickly follows, and after a short time there is a very slight increase in intra-ocular tension. The dilatation of the pupil is complete for some days, and rarely passes off under a week; the paralysis of accommodation disappears somewhat earlier. The increase in intra-ocular tension is unimportant in most individuals, but in some predisposed to glaucoma it appears to bring on this disease, and to increase it if present.

The application of 1 per cent. solutions of atropine to the eye usually produces general symptoms and, not infrequently, symptoms of poisoning. It may also produce local irritation (follicular conjunctivitis). This strength should therefore be used with care, and should be limited to those conditions, such as iritis, in which it is necessary to employ it. For many purposes a 1 in 1,000 solution is sufficiently strong. This strength produces, in normal eyes, dilatation in less than an hour, which reaches its maximum in ninety minutes, and lasts three or more days.

**Hyoscyamine**, if pure, is very similar in action to atropine. It is more powerful, but presents few other points of difference. Commercial hyoscyamine, however, contains a notable quantity of hyoscyne, and hence in moderate doses it may act as a cerebral sedative rather than a deliriant. Owing to its variable composition, its action on the brain is therefore inconstant. Its action on the nerve-endings in involuntary muscle and secretory glands is the same as that of atropine, but nearly twice as powerful.

**Hyoscyne** (scopolamine), while possessing an action comparable to that of atropine on the peripheral nerve-endings, has a very different action on the brain. Small doses ( $\frac{1}{1000}$  grain) produce a sense of calmness which terminates in sleep. On awakening, some dryness of the mouth is usually



present. It is a more powerful mydriatic (pupil-dilator) than atropine (see page 271).

The uses of atropine and the preparations of belladonna are, in general terms—locally applied, to relieve irritation, to diminish secretion, to dilate the pupil; taken internally, to relieve irritation and pain (colic, &c.), to diminish secretion (sweating, &c.), to relax spasm (asthma, &c.), to influence the heart (syncope from chloroform, &c.), as a stimulant to the

respiratory centre (opium poisoning, &c.) Children bear atropine well.



FIG. 1.

Upper end of branch of Belladonna, showing shape and disposition of leaves, flower, and fruit.  $\frac{1}{2}$  linear.

#### BELLADONNA

The fresh leaves and branches and the dried root are official.

#### **Belladonnæ Folia.**

—‘The fresh leaves and branches of *Atropa Belladonna*, *Linn.*, collected when the plant is in flower.’

*Characters*.—The leaves are 3 to 8 inches long, shortly stalked, ovate in shape, with an acute apex and an entire margin, and are usually quite free of hairs. They are divided into two unequal portions by the midrib. They occur alternately below and in unequal pairs above. The

campanulate corolla is dark bluish-purple in colour. The fruit, which is sometimes present along with the flowers, is black and shining.

*Active Principles*.—**Hyoscyamine**, **atropine**, **belladonnine**, &c. Total alkaloids 0·3 to 0·7 per cent. of dried leaves.

*Pharmacology.*—Its pharmacological action is that of the alkaloids it contains, and is therefore the same as atropine.

**Extractum Belladonnæ Viride.**—A ‘green’ extract (see page 23). Contains, as a rule, from 1 to  $1\frac{1}{4}$  per cent. of alkaloids.

*Dose.*— $\frac{1}{4}$  to 1 grain.

*Pharmacology.*—Its action is similar to that of the alcoholic extract (see below), but, as it is not standardised, different samples may vary considerably in the amount of active alkaloids they contain. It may be used for the same purposes as the alcoholic extract.

**Succus Belladonnæ.**—The juice of the fresh leaves and young branches, to which  $\frac{1}{3}$  its volume of alcohol (90 per cent.) has been added.

*Dose.*—5 to 15 minims.

It generally contains about 0·15 per cent. of alkaloids. It is an unnecessary preparation, and is rarely used.

**Belladonnæ Radix.**—‘The root of *Atropa Belladonna*, *Linn.*, collected in the autumn and dried.’



FIG. 2.

Belladonna root: whole and longitudinally split specimens.  
 $\frac{2}{3}$  linear.

*Characters.*—Nearly cylindrical in shape, six inches or more in length,  $\frac{3}{8}$  to  $\frac{3}{4}$  inch in thickness. The bark is of a pale greyish-brown colour, and is finely wrinkled longitudinally. The transverse section shows a distinct bark

separated by a dark line (cambium) from a whitish starchy wood, which is studded with darker spots (groups of vessels). The fracture is short and mealy. The larger pieces are usually split longitudinally.

*Active Principles.* — **Hyoscyamine, atropine**, small amounts of hyoscine (scopolamine), belladonnine, and less important alkaloids. Total alkaloids 0·4 to 0·6 per cent., occasionally more. Most, if not all of the atropine obtained from the belladonna plant results from conversion of hyoscyamine during the process of extraction.

*Pharmacology.*—Its action is that of the atropine and hyoscyamine it contains. The quantity of other alkaloids present is too insignificant to exert much influence.

**Extractum Belladonnæ Liquidum.**—Contains 0·75 gramme of total alkaloids in 100 c.c.

All other preparations of belladonna root are made from this. It is used only for this purpose. It varies considerably in colour and hence the other preparations of belladonna root also vary.

**Extractum Belladonnæ Alcoholicum.**—Contains 1 per cent. of the alkaloids of belladonna root.

Prepared by evaporating the liquid extract to a thin syrup, adding a predetermined quantity of milk sugar and continuing the evaporation until the extract is of required strength.

*Dose.*— $\frac{1}{4}$  to 1 grain.

*Pharmacology.*—Its action is practically that of a preparation containing 1 per cent. of atropine. It is usually administered as a pill, consequently its action is somewhat slower in appearing, is somewhat less marked, but correspondingly more prolonged than a 1 per cent. solution of atropine. It may be given for any condition in which atropine is useful; but it is most commonly administered, in the form of a pill, to obtain the action of atropine on the intestines, as in colic, &c. It is often combined with purgatives to prevent their griping action.

**Suppositoria Belladonnæ.**—Each suppository contains  $1\frac{1}{2}$  grains of alcoholic extract of belladonna, or approximately  $\frac{1}{60}$  grain of the alkaloids of belladonna root.

*Pharmacology.*—They exert a sedative action on the lower part of the rectum and diminish its secretion, but are commonly used to obtain the general effect of atropine. In this way the local effect on the stomach and intestines is avoided.

**Emplastrum Belladonnæ.**—Contains 0·5 per cent. of the alkaloids of belladonna root.

Liquid extract of belladonna, 4 fl. oz. evaporated to 1 fl. oz.; resin plaster, 5 oz.

*Pharmacology.*—Applied to the skin it diminishes secretion and relieves pain. It is employed as a local sedative and as a breast plaster to stop the secretion of milk. Absorption of the alkaloids may occur through the skin, sometimes in sufficient amount to cause symptoms of poisoning. This is especially liable to happen if abrasions are present.

**Linimentum Belladonnæ.**—Contains 0·375 per cent. of the alkaloids of belladonna root and a little camphor.

Liquid extract of belladonna, 10 fl. oz.; camphor, 1 oz. distilled water, 2 fl. oz.; alcohol (90 per cent.), to make 20 fl. oz.

*Pharmacology.*—It has a similar action to the plaster, but is at first somewhat stimulating on account of the alcohol and camphor it contains. It is used as a sedative to relieve superficial pain.

**Tinctura Belladonnæ.**—Contains 0·05 per cent. of the alkaloids of belladonna root.

Liquid extract of belladonna, 1 fl. oz.; alcohol (60 per cent.), to make 15 fl. oz.

*Dose.*—5 to 15 minims.



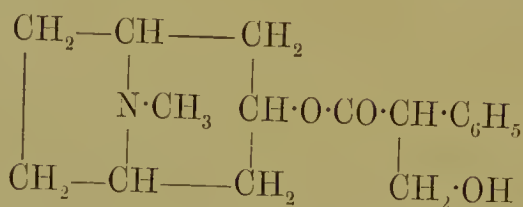
*Pharmacology*.—Used to obtain the general effects of atropine. It is generally given in the form of a mixture to diminish secretions (cutaneous, bronchial, &c.), as a sedative to the urinary system, and as an aid to the action of purgatives. Except for the two last-named purposes, *Liquor Atropinæ Sulphatis* is better.

**Unguentum Belladonnæ**.—Contains 0·6 per cent. of the alkaloids of belladonna root.

Liquid extract of belladonna, 2 fl. oz. evaporated to  $\frac{1}{4}$  oz.; benzoated lard,  $2\frac{1}{4}$  oz.

*Pharmacology*.—Applied locally it diminishes pain and secretion. The alkaloids may be absorbed and produce a general effect, but the ointment is not used for this purpose. It may be employed as a sedative to relieve acute inflammatory conditions (commencing abscess, &c.) beneath the skin, to relieve superficial neuralgia and cutaneous irritation. A solution of extract of belladonna (usually the green extract) in glycerin is preferred for most purposes.

**Atropina**.—‘An alkaloid,  $C_{17}H_{23}NO_3$ ,’ the solutions of which do not rotate a ray of polarised light, ‘obtained from belladonna leaves or root.’



*Characters*.—Colourless glistening acicular crystals. Soluble in 300 parts of water, in  $2\frac{1}{2}$  parts of absolute alcohol, in 2 parts of chloroform, and in 35 parts of pure ether. Its aqueous solution has an alkaline reaction and a persistent bitter taste.

Melting-point,  $115^\circ$  to  $115\cdot5^\circ C$ . If moistened with fuming nitric acid and evaporated on a water-bath to dryness it leaves a colourless residue, which turns at first violet and then cherry-red on the addition of a few drops of freshly prepared alcoholic potash. Hyoscyamine, hyoscyne, and

homatropine give the same test. (Veratrine also gives the same reaction, but can be easily distinguished by physiological tests.) The gold-salt of atropine is characteristic, and serves to distinguish it from hyoscyamine and other allied alkaloids.

*Dose.*— $\frac{1}{200}$  to  $\frac{1}{100}$  grain.

*Pharmacology.*—See page 257.

**Unguentum Atropinæ.**—Contains 2 per cent. by weight of atropine.

Atropine, 1 ; oleic acid, 4 ; lard, 45.

*Pharmacology.*—It has a local sedative action, and is used mainly for this purpose in neuralgia, diseases of the cornea, &c. It will, however, produce the other local effects of atropine, and it may be absorbed and produce a more or less marked general action. It is frequently used in the treatment of iritis.

**Atropinæ Sulphas**— $(C_{17}H_{23}NO_3)_2H_2SO_4$ .

The commercial salt often contains a molecule of water of crystallisation.

*Characters.*—A colourless or nearly colourless crystalline powder. Soluble in less than its weight of water, and in 4 parts of alcohol ; insoluble in ether or chloroform.

Melting-point,  $190^{\circ}C$ . Alkalies precipitate atropine from strong aqueous solutions. It should contain no mineral matter.

*Dose.*— $\frac{1}{200}$  to  $\frac{1}{100}$  grain.

*Pharmacology.*—See page 257.

**Lamellæ Atropinæ.**—Each contains  $\frac{1}{5000}$  grain of atropine sulphate.

*Pharmacology.*—They are a convenient preparation for applying atropine to the eye. They soon dissolve in the tears and produce a local sedative effect. The pupil begins to dilate in about an hour, and the dilation lasts 2 or 3 or more days.

**Liquor Atropinæ Sulphatis.**—A 1 per cent. aqueous solution of atropine sulphate.

Atropine sulphate, 1 gramme; salicylic acid, 0·12 gramme; distilled water, recently boiled and cooled, 100 c.c.

*Dose*.— $\frac{1}{2}$  to 1 minim.

*Pharmacology*.—It has the action already described and is the preparation of atropine most largely used. It is given by the mouth to stop temporarily the sweating of phthisis, to diminish the bronchial secretion when excessive, to cut off the vagus action on the heart, to relieve mild constipation, and to relax spasm of involuntary muscle. It is useful in bronchitis and broncho-pneumonia in children, in spasmodic asthma, whooping cough, and false croup, in ptyalism, in lead colic, and sometimes in neuralgia. It is given subcutaneously as a respiratory stimulant in opium poisoning and to paralyse the vagus endings in the heart before administering chloroform to prevent syncope. It is applied to the eye in corneal ulceration and to dilate the pupil and prevent adhesions forming to the lens in iritis. This strength, however, is liable to produce general effects and should be used with care.

#### HYOSCYAMUS LEAVES

**Hyoscyami Folia**—henbane leaves. ‘The fresh leaves and flowers, with the branches to which they are attached, of *Hyoscyamus niger*, *Linn.*; also the leaves and the flowering tops, separated from the branches and carefully dried. Collected from the flowering biennial plants.’

*Characters*.—The leaves vary considerably in size. The lower are large, being sometimes 10 inches in length, and are stalked. The upper are much smaller and are sessile. They are pale green in colour, ovate or triangular-ovate in shape, hairy, and have a markedly dentate margin and a broad midrib.

The dried tops occur in irregularly flattened cone-like or rounded masses, 1 inch to 2 inches in diameter, usually distinctly hairy and generally showing small patches of yellowish corolla marked with purplish veins. The flowers are seen

best after taking away a few of the external leaves. The odour of the fresh leaves is characteristic, the taste is bitter and somewhat acrid.

*Active Principles.*—**Hyoscyamine, atropine, hyoscine.**

Total alkaloids, 0·1 to 0·2 per cent. of dried leaves.

From the **fresh** branches are made—

**Extractum Hyoscyami Viride.**—A ‘green extract’ (see page 23). It contains,



FIG. 3.

Dried *Hyoscyamus* leaf expanded in water.  $\frac{1}{2}$  linear.



FIG. 4.

Dried flowering top of *Hyoscyamus niger*. Note flowers showing veins. Natural size.

as an average, 0·2 per cent. of alkaloids, but its strength may vary considerably.

*Dose.*—2 to 8 grains.

*Pharmacology.*—Its action is similar to, but much weaker ( $\frac{1}{5}$  or more), than that of alcoholic extract of belladonna. It is somewhat more sedative on account of the small quantity of hyoscine it contains. It is used mainly to prevent the griping produced by purgatives.



**Pilula Colocyntidis et Hyoscyami.**—A purgative pill consisting of compound pill of colocynth 2; extract of hyoscyamus 1. See page 389.

**Succus Hyoscyami.**—The juice of the fresh leaves &c. to which one-third its volume of alcohol (90 per cent.) has been added.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is similar to that of the tincture, and it may be used for the same purposes, but is much less frequently employed.

Prepared from the **dried** leaves and flowering tops.

**Tinctura Hyoscyami.**—Contains the active principles of 1 of crude drug in 10 of product, or about 0.01 to 0.02 per cent. of alkaloids.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is similar to that of tincture of belladonna but is much weaker, and, owing to the hyoscyne it contains, more sedative. It is used largely in the treatment of urinary diseases, especially if there is vesical irritation. It is also used in asthma, whooping cough, and other spasmodic affections, and in the treatment of constipation and colic.

#### STRAMONIUM LEAVES

**Stramonii Folia.**—‘The dried leaves of *Datura Stramonium*, *Linn.*’

*Characters.*—The dried leaves have a minutely wrinkled, twisted appearance, an unpleasant bitter taste, and a somewhat characteristic odour. On expanding them in water they are seen to be 4 to 6 inches long, ovate or triangular-ovate in shape, with an acute apex and an irregular markedly dentate margin. They are somewhat uneven at the base and petiolated. The upper surface is dark-greyish-green, the under surface paler.

They cannot be readily confounded with any other official drug, except, perhaps, dried hyoscyamus leaves, and these have a broad midrib

and are somewhat hairy. The two leaves can be distinguished at once by expanding them in warm water. The angle (about  $45^\circ$ ) at which the lateral veins leave the midrib in the case of stramonium leaves is helpful, and can often be seen in dried specimens.

*Active Principles.*—

**Hyoscyamine ; atropine ; hyoscyne.** Total alkaloid about 0.3 per cent. of dried leaves.

Hyoscyamine alone exists in the plant, but is largely converted into atropine during extraction. Daturine, formerly regarded as the active principle, is a mixture of atropine and hyoscyne.



FIG. 5.

Dried Stramonium leaf expanded in water.  
The apex is wanting.  $\frac{1}{2}$  linear.

**Tinctura Stramonii.** — Contains the alkaloids of 1 oz. of dried leaves in 5 fluid ounces, or, roughly, 0.05 to 0.06 per cent. of alkaloids.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Practically the same as tincture of belladonna. It is used mainly in the treatment of asthma. (Powdered stramonium leaves are an important ingredient in many cigarettes and fumigating powders used for asthma.)

**Stramonii Semina.**—‘The dried ripe seeds of *Datura Stramonium*, *Linn.*’

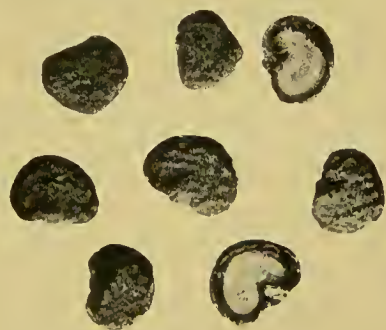


FIG. 6.

Stramonium seeds. Two have been cut longitudinally to show the curved embryo.  $\frac{3}{4}$  linear.

*Characters.*—Nearly black reticulated seeds, of a flattened reni-

form shape, about  $\frac{1}{6}$  inch long, and having an unpleasant, somewhat bitter taste, but no distinctive odour.

On longitudinal section the curved embryo is readily seen.

*Active Principles*.—Same as the leaves. They contain about 0.4 per cent. of alkaloids.

**Extractum Stramonii**.—An alcoholic extract.

*Dose*.— $\frac{1}{4}$  to 1 grain.

*Pharmacology*.—Its action is similar to that of the extracts of belladonna. It may be used for the same purposes, but is employed usually in the treatment of asthma.

#### HYOSCYAMINE SULPHATE

**Hyoscyaminæ Sulphas**.—‘The sulphate,  $(C_{17}H_{23}NO_3)_2$ ,  $H_2SO_4, 2H_2O$ , of an alkaloid contained in Hyoscyamus Leaves, and possibly other solanaceous plants.’

*Characters*.—Slender needles or crystalline powder, deliquescent, with a bitter, acrid taste. Soluble in half its weight of water and in  $2\frac{1}{2}$  parts of alcohol, very slightly soluble in ether or chloroform.

Melting-point  $204^\circ C$ . (the commercial salt melts at about  $200^\circ C$ .). The alkaloid gives the same reactions as atropine, but it can be distinguished from atropine by the characters of its gold salt.

*Dose*.— $\frac{1}{200}$  to  $\frac{1}{100}$  grain.

*Pharmacology*.—For the action of pure hyoscyamine see page 259. Commercial hyoscyamine frequently produces cerebral depression, and, in some individuals, sleep, but its action is uncertain, and as a sedative and hypnotic its use has been abandoned.

#### HYOSCINE HYDROBROMIDE

**Hyoscinae Hydrobromidum** — Scopolamine hydrobromide. ‘The hydrobromide,  $C_{17}H_{21}NO_4, HBr, 3H_2O$ , of an alkaloid contained in Hyoscyamus Leaves, different species of Scopolia, and possibly other solanaceous plants.’

*Characters.*—Colourless rhombic crystals, with an acrid somewhat bitter, taste. Soluble in 4 parts of cold water and in 20 parts of alcohol, sparingly soluble in ether or chloroform. Its aqueous solution is often slightly acid.

Melting-point, of anhydrous salt, 181°C. The alkaloid forms a characteristic gold salt.

*Dose.*— $\frac{1}{200}$  to  $\frac{1}{100}$  grain.

*Pharmacology.*—Hyoscine has a similar action to atropine on the nerve-endings in involuntary muscle and secretory glands, but is more powerful and more transient. It differs, however, from atropine in its action on the brain. Instead of excitement it produces, in most persons, calmness and sleep. It also appears to have no stimulating action on the medullary centres. Its central action is, in part, on the motor areas, and it is of considerable service in diminishing the activity of these. Thus it is largely used to calm maniacal patients, and is frequently useful in the early stages of delirium tremens. Although in certain cases large doses have been given with impunity, small doses have produced serious effects. It is advisable, therefore, to commence with not more than  $\frac{1}{200}$  grain hypodermically. It has been given as a hypnotic in various diseases, and the sleep which often quickly follows is apparently natural, but after-effects, such as somnolence and dryness of the mouth and throat, are not uncommon. Patients soon become more or less accustomed to its use, and the dose has consequently to be increased. It has been given in small doses in various spasmodic diseases—asthma, whooping cough, paralysis agitans, chorea.

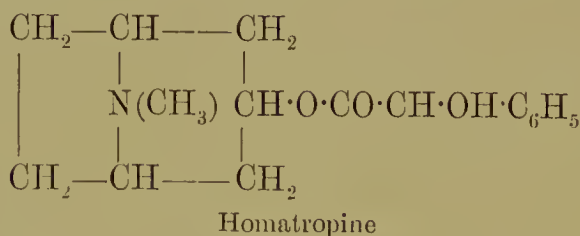
It is also used to dilate the pupil. Its action is quicker, but more transient, than that of atropine, and it is said to be five times more powerful. One drop of 1 in 500 solution produces dilatation, commencing in 8 to 10 minutes and reaching its maximum in 45 minutes, and commencing ciliary paralysis in about 25 minutes. The dilatation is complete for 24 to 30 hours, and disappears after about 72 hours. Paralysis of accommodation lasts 24 to 36 hours, but does not completely disappear before 96 hours. It is recommended as a substitute for atropine in iritis and other conditions.



Hyoscine has been given latterly with morphine previous to surgical operations (morphine-scopolamine anæsthesia). This method, however, does not give sufficient anæsthesia for most purposes, but it is sometimes a useful adjunct to ordinary general anæsthetics.

#### HOMATROPINE HYDROBROMIDE

**Homatropinæ Hydrobromidum.**—‘The hydrobromide,  $C_{16}H_{21}NO_3 \cdot HBr$ , of an alkaloid prepared from tropine.’



It is obtained by condensing tropine and phenyl-glycollic (oxytoluic or mandelic) acid. It is therefore the tropine of phenyl-glycollic acid, mandelic acid, &c.

*Characters.*—Small colourless, prismatic crystals, or a white crystalline powder, with a slightly bitter taste. Soluble in 6 parts of water, slightly soluble in absolute alcohol.

A 2 per-cent. solution is not precipitated by the cautious addition of solution of ammonia diluted with twice its volume of water. (Salts of atropine similarly treated give a precipitate of atropine.) Dilute caustic potash solution precipitates homatropine from solutions of the hydrobromide, and the precipitate is readily soluble in excess of the solution. (Atropine precipitated from its salts in a similar manner is not so soluble in excess of the solution.)

*Dose.*— $\frac{1}{80}$  to  $\frac{1}{20}$  grain.

*Pharmacology.*—Its action is similar to, but much weaker than, that of atropine. It is used mainly for dilating the pupil for testing errors of refraction. After applying a 1 per cent. solution to the conjunctiva the pupil begins to dilate in 5 to 10 minutes, is almost fully dilated in 40 to 50 minutes, and remains so for 2 to 3 hours, when the effect gradually begins to disappear, and in 24 to 30 hours the eye is generally normal.

**Lamellæ Homatropinæ.**—Each contains  $\frac{1}{100}$  grain homatropine hydrobromide.

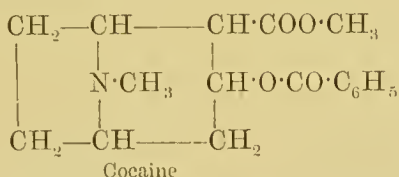
*Pharmacology.*—It is a stable and portable preparation of homatropine hydrobromide. Its action is the same as that of a 1 per cent. solution.

## COCA

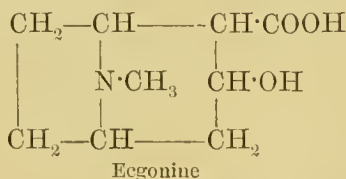
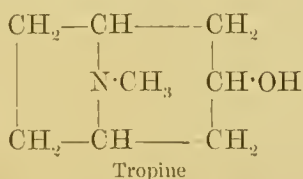
The leaves of *Erythroxylum Coca* yield a number of closely related alkaloids, the most important of which is cocaine (lævo-cocaine).

The alkaloids are usually extracted in South America, and are exported as crude cocaine. A good sample of this contains 94 per cent. of cocaine (*l*-cocaine), but usually the quantity varies from 78 to 89 per cent. The other alkaloids are *d*-cocaine, cinnamyl-cocaine, truxilline, benzoyl-ecgonine, &c. These are utilised for making cocaine by partial synthesis.

Cocaine is methyl-benzoyl-ecgonine. By boiling with water it is broken up into methyl alcohol and benzoyl-ecgonine, and the latter, by the action of a mineral acid or baryta-water, can be further decomposed into benzoic acid and ecgonine.

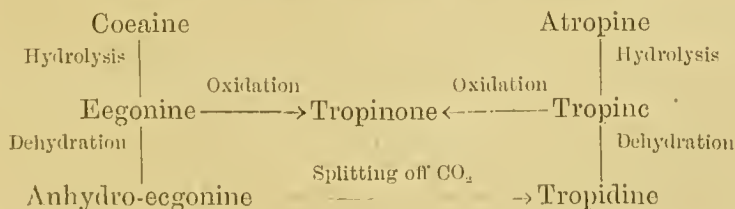


Ecgonine is a derivative of tropine (see atropine), being a  $\beta$ -carboxylic acid of tropine.



The relation between cocaine and atropine will be best understood from the following table taken from Schmidt's work (page 70) :

## RELATION BETWEEN COCAINE AND ATROPINE



The relation is of some importance, as it has led to the discovery of new and useful drugs.

*The Pharmacological Action of Cocaine.*— Locally applied, cocaine paralyses sensory nerve-endings, and thus acts as a local anæsthetic. After absorption into the blood it produces cerebral stimulation.

A strong aqueous solution (10 to 20 per cent. of the hydrochloride) produces very little effect on the intact skin, but applied to mucous membranes it causes local pallor and numbness. If injected under the skin, anæsthesia quickly follows and lasts a variable time, dependent on the quantity given and the facilities it has for being absorbed. After the injection of 5 minims of a 10 per cent. solution complete local anæsthesia develops in 5 to 20 minutes and lasts about 15 or 20 minutes.

Applied to the eye, a 4 per cent. solution produces slight transient pain, quickly followed by contraction of the conjunctival vessels and diminished sensitiveness, and later by dilatation of the pupil, which, however, remains active to light. Complete anæsthesia results in 15 to 20 minutes, and lasts 10 to 15 minutes longer. The dilatation of the pupil and certain other unimportant effects are due to stimulation of the terminations of the sympathetic nerve.

When taken by the mouth,  $\frac{1}{2}$  to 1 grain produces, after a short interval, a sense of exhilaration and increased mental capacity, which is usually followed by no other effects. The action of cocaine, however, varies in different individuals, and, in some, headache, faintness, and other serious effects, may occur. After larger doses there is marked restlessness and talkativeness, followed by anxiety, muscular weakness, convulsive tremors, hallucinations and often cardiac and respiratory distress; the pupil is somewhat dilated and the eyelids may be slightly retracted. Recovery usually occurs in 6 to 8 hours.

Cocaine acts first upon the higher centres, and later, if the dose is sufficient, upon the lower centres of the brain, and on the spinal cord. The action on the lower cerebral centres is seen best in dogs and is expressed in convulsions. The

medullary centres are stimulated; hence respiration and the circulation are affected. Respiration becomes more rapid; the heart increases in frequency (owing to stimulation of the accelerator mechanism, and probably also to a direct action on the muscle), and the blood-vessels are contracted; hence the blood-pressure rises. Its action on other organs is unimportant. The sensory nerves are not distinctly affected by cocaine circulating in the blood; therefore its action as a local anæsthetic is due merely to the relatively large quantity at the point of application.

The repeated use of cocaine is liable to produce a habit which almost invariably leads to **cocainism**. The symptoms vary, but there is usually mental weakness, sleeplessness, hallucinations, and perverse sensations (as of ants, lice, &c., creeping over the skin), with headache, dizziness, &c., and very commonly digestive troubles.

**Cocæ Folia.**—‘The dried leaves of *Erythroxylum Coca*, *Lam.*, and its varieties.’ Two varieties are official—Huanuco or Bolivian, and Truxillo or Peruvian.



FIG. 7.

Dried Coca leaves. *a*, upper surface; *b*, under surface, showing slightly curved dark line on each side of midrib. The apiculus has been broken off. Natural size.

**Characters.**—The leaves are oval in shape, have an entire margin, a midrib terminating in a horny apiculus



(usually broken off), and on the under surface a dark curved line on each side of the midrib. They are glabrous. The odour is faint but characteristic; the taste is slightly bitter, and is followed by a sensation of numbness.

Bolivian coca leaves are brownish-green in colour,  $1\frac{1}{2}$  to 3 inches long, and 1 to  $1\frac{1}{2}$  inches broad. They show a distinct ridge above the midrib on the upper surface, and the curved lines on the under surface are generally well marked.

Peruvian coca leaves are pale green in colour, smaller in size, more fragile, and hence usually presenting a broken appearance, and have no distinct ridge above the midrib on the upper surface. The curved lines on the under surface are also often indistinct.

Other varieties of coca leaves (not official) are imported from Java and Ceylon.

*Chief Constituents.* — **Cocaine** (*l*-cocaine), *d*-cocaine, *l*-cinnamyl-cocaine,  $\alpha$ - and  $\beta$ -truxilline, benzoyl-ecgonine (probably a decomposition product). The quantity of total alkaloid varies, but is rarely more than 1 per cent. (0.8 per cent. has been suggested as a standard). A small quantity of tannin (coca-tannic acid), and less important substances are also present.

The leaves deteriorate unless carefully kept. The cocaine is apparently converted into benzoyl-ecgonine, which is practically inert. In Peruvian leaves cinnamyl-cocaine and truxilline often preponderate. Cinnamyl-cocaine on hydrolysis gives methyl alcohol, cinnamic acid, and ecgonine; truxilline gives methyl alcohol, truxillic acid, and ecgonine. (Tropacocaine, recently introduced into medicine, occurs in Java coca leaves.)

**Extractum Cocæ Liquidum.**—Contains the active principles of 1 ounce of leaves in 1 fluid ounce.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has a similar action to cocaine, but it is uncertain in composition and therefore little used.

**Cocaina.**—‘An alkaloid,  $C_{17}H_{21}NO_4$ , obtained from the leaves of *Erythroxylum Coca*, *Lam.*, and its varieties.’

*Characters.*—Colourless prismatic crystals without odour, but with a bitter taste, which is followed by a sensation of tingling and numbness in the mouth. Very slightly soluble in water (about 1 in 1,300), soluble in 10 parts of 90 per cent.

alcohol, in 4 parts of ether, in  $\frac{1}{2}$  part of chloroform, in 12 parts of olive oil, and in 14 parts of oil of turpentine; insoluble in glycerin.

Melting-point  $98^{\circ}\text{C}$ . It should contain no chlorides or sulphates. For tests see below.

*Pharmacology*.—See above (page 274). The hydrochloride of cocaine is not soluble in fats, and hence is not adapted for making ointments. The base should always be used for this purpose.

**Unguentum Cocainæ.**—Contains 1 of cocaine in 25.

Cocaine, 1; oleic acid, 4; lard, 20.

*Pharmacology*.—When rubbed into the skin it has a distinct sedative (numbing) action, which is still more marked when it is applied to denuded surfaces. It is used to diminish pain and irritability in various forms of skin disease, and in corneal affections. It is sometimes useful in superficial neuralgias.

**Cocainæ Hydrochloridum**— $\text{C}_{17}\text{H}_{21}\text{NO}_4\cdot\text{HCl}$ .

*Characters*.—Colourless prismatic crystals, or needles, or a crystalline powder, with a bitter taste followed by numbness. Soluble in half its weight of water, in 3 parts of 90 per cent. alcohol, or of glycerin; insoluble in pure ether and in fixed oils.

Melting-point  $186^{\circ}\text{C}$ . If a 1 per cent. solution of potassium permanganate is added drop by drop to a strong aqueous solution of cocaine hydrochloride, a violet crystalline precipitate of cocaine permanganate separates out. If moistened with nitric acid and evaporated to dryness, the addition of a drop of alcoholic potash produces a characteristic odour resembling somewhat that of peppermint.

The Pharmacopœia gives tests to prove the absence of cinnamylcocaine, cocamine (*α*-truxilline), and products derived from cocaine, but they are not very satisfactory. The salt should contain not more than traces of sulphates, or more than 1 per cent. of moisture.

*Dose*.— $\frac{1}{5}$  to  $\frac{1}{2}$  grain.

*Pharmacology*.—Its action has been described (see page 274). It is used only to relieve pain in accessible regions, and as a local anæsthetic in minor operations. It is

employed largely in 2 to 4 per cent. solutions as a local anæsthetic for operations on the eye. Three or four applications of a few drops of the solution are made at intervals of five minutes.

For the excision of small tumours a few drops of a 5 per cent. solution are injected at various points around the tumour. In all cases, whatever the condition, the least possible quantity of cocaine which will produce the effect desired should be used, and, if possible, steps should be taken to prevent its absorption into the circulation. Serious symptoms—fainting, collapse, and others—have frequently resulted from the injection of cocaine even for the extraction of a tooth.

Various methods of using cocaine for serious operations have been described, but only one can be referred to. It is the injection of 1 or 2 per cent. cocaine solutions into the lumbar portion of the spinal cord. This produces anæsthesia of the lower part of the body. It has only limited applications, and is not free from danger.

Cocaine is of little use when administered by the mouth. It will relieve pain in the stomach, but its action is transient. It has been given in various diseases, but it is better avoided, owing to the danger of a habit being acquired.

**Injectio Cocainæ Hypodermica.**—A 10 per cent. aqueous solution of cocaine hydrochloride.

Cocaine hydrochloride, 1 gramme; salicylic acid, 0·015 gramme; recently boiled and cooled distilled water, 10 c.c.

The salicylic acid is a preservative.

*Dose, by subcutaneous injection.*—2 to 5 minims.

*Pharmacology.*—It rapidly produces local anæsthesia, but is too strong for general use. It keeps better, however, than weaker solutions, which can readily be made from it, but it should not be kept for long.

**Lamellæ Cocainæ.**—Each contains  $\frac{1}{50}$  grain of cocaine hydrochloride, and weighs  $\frac{1}{30}$  grain.

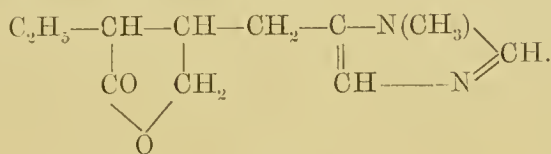
*Pharmacology.*—The lamellæ are used only to apply to the eye. It is a stable and portable preparation.

**Trochiscus Krameriaë et Cocainæ.**—Each lozenge contains  $\frac{1}{20}$  grain of cocaine hydrochloride and 1 grain of extract of krameria. Fruit basis.

*Pharmacology.*—It combines the astringent action of rhatany with the sedative action of cocaine. It is useful in irritable sore throat.

## GLYOXALINE DERIVATIVES

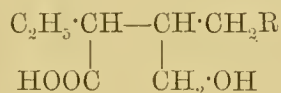
The only members of this group are the alkaloids of jaborandi, viz. pilocarpine and two unimportant alkaloids, iso-pilocarpine and pilocarpidine.



Pilocarpine

Pilocarpine and iso-pilocarpine are stereo-isomers, and consist of a methyl-glyoxaline group (right-hand group in formula) united to a homopilopic radical. Solutions of pilocarpine strongly rotate the plane of polarised light to the left, but, after heating, the rotation is markedly diminished, owing to the pilocarpine having been converted into pilocarpic acid and ultimately iso-pilocarpine. The same change occurs, to a certain extent and very gradually, at ordinary temperatures. Iso-pilocarpine is much less active pharmacologically than pilocarpine.

When a solution of caustic alkali (an equi-molecular amount or more) is added to a solution of pilocarpine, the lactone ring of the homopilopic group (left hand side of formula) is opened, and pilocarpic acid is formed, thus—



This, apart from demonstrating the incompatibility of pilocarpine with caustic alkalies, is also of interest as bearing on the somewhat transient pharmacological action of pilocarpine.

*Pharmacological Action of Pilocarpine.*—This alkaloid, like atropine, acts upon the nerve-endings in involuntary muscular tissue and in secretory glands, but instead of paralyzing these structures it powerfully stimulates them. It therefore causes contraction of unstriated muscle, increases the various secretions, and produces an effect on the heart



(except, after small doses, in man) similar to that obtained by electrical stimulation of the vagus trunk.

After taking  $\frac{1}{12}$  grain by the mouth (best in the form of a salt) there appears in about ten minutes slight salivation, soon followed by just appreciable perspiration. These symptoms last about half an hour, and then gradually disappear. After larger doses ( $\frac{1}{6}$  grain) the salivation and perspiration are well marked, there is a feeling of coldness, and a curious sensation about the eyes. The pulse, in contradistinction to its effect in lower animals, is somewhat increased in frequency, and there is often slight nausea. Much larger doses (1 grain or more) cause profuse salivation and sweating, usually nausea, and often vomiting, and in some people faintness and even collapse; the pupils are contracted, and more or less spasm of accommodation is present. There is often vesical strangury as a result of contraction of the bladder, and there may be defecation, owing to contraction of the intestine. Unstriated muscle in other parts of the body is also affected, and the other secretions, except the urine, are increased. The bronchial secretion is sometimes sufficiently profuse to be troublesome.

Hypodermic injection of a pilocarpine salt produces the same effects. The symptoms appear somewhat earlier, but there is no essential difference. After the injection of  $\frac{1}{6}$  grain of pilocarpine nitrate (the dose usually given, and one which should not be exceeded), salivation and perspiration commence in 5 to 10 minutes and last 2 or 3 hours or more.

When a 1 per cent. solution (in 0.6 per cent. salt solution) is dropped into the eye, the pupil begins to contract in 10 to 15 minutes, and remains contracted for about  $2\frac{1}{2}$  hours. Spasm of accommodation also occurs, and may be accompanied by an aching pain, and there is a slight diminution in intra-ocular tension.

These various effects are due to stimulation of the nerve-endings in the different tissues. The heart, and, as far as is known, all unstriated muscle and secretory glands are affected. (The increase in the frequency of the pulse in man, after small doses, is probably secondary to the nausea.)

Its depressant action on the heart is unfortunate, since it is of no therapeutic value, and often gives rise to serious effects such as fainting and collapse. The increase in bronchial secretion in some patients also leads to interference with respiration and even cyanosis.

*Antagonism.*—The diametrically opposite actions of atropine and pilocarpine on the nerve-endings raises the question of the antagonistic action of these two alkaloids. This question cannot be entered into here, but one or two facts may be noted. For practical purposes it may be said that atropine will antagonise the action of pilocarpine, but pilocarpine not that of atropine. In reality they are mutually antagonistic, but while a small dose of atropine will antagonise a large amount of pilocarpine, it requires a large dose of pilocarpine to antagonise a small quantity of atropine. The proportion varies with the doses administered. Thus, if a mixture of the two alkaloids be given, it can be shown experimentally (action on vagus in heart) that, with a dose of pilocarpine producing a just appreciable effect, the addition of  $\frac{1}{40}$  the quantity of atropine will annul this effect; but if very large doses of pilocarpine be used, the addition of  $\frac{1}{1000}$  the quantity of atropine will counteract its action for a definite time, but not permanently. Conversely, after a distinct atropine action has been produced with the smallest quantity of alkaloid, the administration of a large dose of pilocarpine will produce a pilocarpine effect, but this will be much less marked than under normal conditions. The antagonism of pilocarpine and atropine is what is usually termed physiological; it is not chemical.

**Jaborandi Folia.**—‘The dried leaflets of *Pilocarpus Jaborandi*, *Holmes*.’

*Characters.*—The leaflets are  $2\frac{1}{2}$  to 4 inches long, dull green in colour (more or less yellow after exposure to light), and coriaceous in texture; oval-oblong or oblong-lanceolate in shape, having an entire and slightly revolute margin, and an obtuse emarginate apex. They have a short petiole and well-marked veinlets. When examined by transmitted light,

numerous oil-glands are seen scattered in the mesophyll. When bruised they exhale a slight aromatic odour; when chewed they have a somewhat bitter aromatic (afterwards pungent) taste, and induce a flow of saliva.



FIG. 8.

Jaborandi leaflet. Natural size.

Cherry-laurel leaves resemble somewhat jaborandi leaflets, but are only official in the fresh state. They can be easily distinguished, even if dry, by the serrated margin, the pointed apex, and the absence of oil-glands.

Several varieties of jaborandi occur in commerce, the official variety being frequently rare.

*Chief Constituents.*—**Pilocarpine**; small quantities of iso-pilocarpine and pilocarpidine; a volatile oil (about 0.5 per cent.). The amount of alkaloid varies; a good specimen yields 0.7 per cent.

**Extractum Jaborandi Liquidum.**—Contains the principles of 1 ounce of crude drug in 1 fluid ounce of product.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action is that of the pilocarpine it contains, which is a variable quantity. Consequently the action of the preparation is inconstant. It is rarely used, having been superseded by pilocarpine nitrate.

**Tinctura Jaborandi.**—Contains the active ingredients of 1 ounce of crude drug in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—The same remarks apply as in the case of the liquid extract. It is somewhat uncertain in action, and it is advisable, therefore, to employ the alkaloidal salt.

**Pilocarpinæ Nitrates.**—‘The nitrate of an alkaloid,  $C_{11}H_{16}N_2O_2, HNO_3$ , obtained from jaborandi leaves.’

The nitrate crystallises better than the hydrochloride, which is hygroscopic.

*Characters.*—Small colourless crystals or a white crystalline powder with a bitter taste. Soluble in 7 parts of water, and in 150 parts of cold alcohol.

Melting point  $174^{\circ}$  to  $178^{\circ}C$ . No characteristic chemical test is known.

*Dose.*— $\frac{1}{20}$  to  $\frac{1}{2}$  grain.

*Pharmacology.*—Its action has been described (page 279). Its uses are few, and are almost limited to the elimination of toxic substances from the blood by means of the sweating induced. Thus in renal disease, with scanty urine, improvement is sometimes obtained and possibly uræmia averted by the excessive sweating produced by a hot-air bath and a hypodermic injection of pilocarpine nitrate. This treatment must be used with care, as it is liable to cause collapse; one-sixth grain pilocarpine nitrate should not be exceeded.

Pilocarpine nitrate has been given to absorb effusions (into pleura, &c.); as a remedy for chronic skin diseases with a dry, thickened skin; for detached retina and various other conditions. It is of questionable value. Locally it has been used to contract the pupil and diminish the intraocular tension of glaucoma, and as an ointment or lotion to stimulate the growth of hair. A hypodermic injection sometimes relieves the intolerable itching of jaundice.

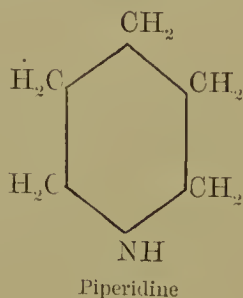
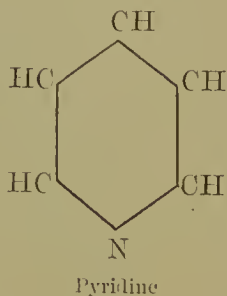
## PYRIDINE DERIVATIVES

The official drugs containing alkaloids belonging solely to this class are few and relatively unimportant. They are conium, pepper, and pellitory root.

Probably the alkaloids of broom, of pomegranate bark, and other drugs also belong to this group, but as this is not definitely known they are best considered later. Other alkaloids—*e.g.* atropine, cocaine—which formerly were regarded as belonging to this class, have another and probably more characteristic ring system.



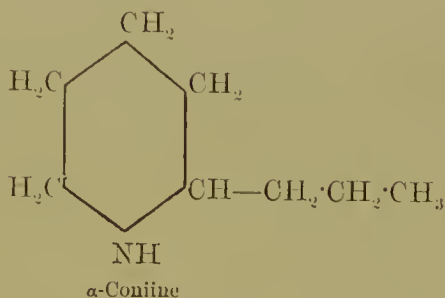
The alkaloids of conium, pepper, and pellitory root are derivatives of piperidine (hexa-hydro-pyridine). They fall into two groups, those of conium on the one hand, and those of pepper and pellitory root on the other.



### CONIUM

The fresh leaves and young branches and the dried fruit are official. The active ingredient is a liquid alkaloid—coniine.

Coniine is *α*-normal-propyl-piperidine. It has been completely synthesised, and is the simplest natural alkaloid known. It is slightly soluble in water, and has a characteristic mousey odour.



*Pharmacological Action of Coniine.*—The most important action of coniine is a paralysing action which is probably due to an effect on the motor nerves. The symptoms it produces, however, are somewhat different from those seen after curare.

After taking a poisonous dose of coniine or of hemlock there is a feeling of weakness in the lower limbs, which gradually increases to paralysis and extends upwards until the respiratory muscles are affected. The complex of symptoms is varied, but no others are characteristic. Vomiting is common, and the intellect usually remains clear until near the end. In some cases (in animals especially) convulsions, probably asphyxial, have been recorded.

Its action on individual organs is unimportant. It is said to have a sedative influence on the sensory nerve-endings, and the crude preparations have been used mainly for this purpose. Its mode of action is still disputed.

**Conii Folia.**—‘The fresh leaves and young branches of *Conium maculatum*, *Linn.*, collected when the fruit begins to form.’

*Characters.*—The leaves vary in size, the lower ones reaching 2 feet in length. Their shape will be best under-



FIG. 9.

A portion of a *Conium* leaf.  $\frac{3}{4}$  linear.

stood from the figure. The ultimate segments of the leaves terminate in smooth colourless horny points. The petioles of

the larger leaves are hollow and marked with irregularly distributed purplish spots (hence the name spotted hemlock), and at their base encircle the stem. When bruised, the leaves exhale a disagreeable mouse-like odour.



FIG. 10.

Lower portion of petiole of *Conium*, showing encircling base and spots on stem. Natural size.

*Chief Constituents.*—**Coniine**, conhydrine (oxy-coniine), and small amounts of less important alkaloids (methyl-coniine, pseudo-conhydrine,  $\gamma$ -coniceine, ethyl-piperidine). The quantity of alkaloids is very variable. A good specimen contains about 0.2 per cent. when the plant is in flower.

**Succus Conii.**—The expressed juice to which one-third its volume of alcohol (90 per cent.) has been added.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action is inconsistent on account of its uncertain strength. It is of doubtful therapeutic value and is rarely given. Like the tincture, it may be used as an inhalation.

**Unguentum Conii.**—An ointment presumably twice the strength of the succus. Lanolin basis.

Juice of conium 2 fl. oz., evaporated at a temperature not exceeding 60°C. to  $\frac{1}{4}$  fl. oz.; hydrous wool-fat,  $\frac{3}{4}$  oz.

*Pharmacology.*—It has been used as a sedative ointment to relieve the pain of cancer, hæmorrhoids, &c., but it is of little value.

**Conii Fructus.**—‘The dried, full-grown, unripe fruits of *Conium maculatum*, *Linn.*’

*Characters.*—The whole fruit (cremocarp) is broadly ovoid in shape, somewhat laterally compressed, is about  $\frac{1}{8}$  inch long, and is crowned by the depressed stylopod. Each half (merocarp) has five irregular, somewhat crenate ridges, and (micro-

scopically examined) is seen to be without oil-glands (vittæ) or hairs; the endosperm on the commissural surface is

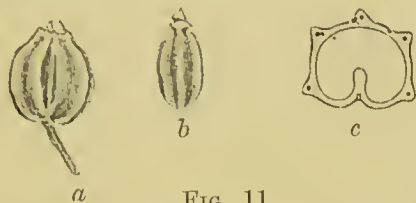


FIG. 11.

Conium Fruit: (a) cremoearp seen laterally; (b) dorsal view of separated meroearp; (c) diagram showing 5 ridges containing fibro-vascular bundles (primary ridges), grooved endosperm, but no vittæ. (Compare figs. 92 to 97). (a) and (b)  $\frac{3}{1}$  linear; (c)  $\frac{12}{1}$  linear.

grooved. The fruits have no smell, but if rubbed with an alkaline solution they exhale a strong mouse-like odour.

Anise fruits somewhat resemble conium fruits. See page 476.

*Chief Constituents.*—Same as the leaves. The fruits are, however, much richer in alkaloids. Over 3 per cent. has been obtained, but the quantity varies considerably.

**Tinctura Conii.**—Contains the active ingredients of 1 ounce of crude drug in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

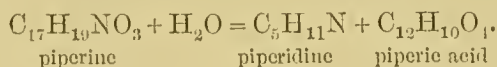
*Pharmacology.*—Its action is that of the coniine it contains, which is a variable quantity. It has been given in certain spasmodic affections (whooping cough, chorea, epilepsy, &c.), but is of doubtful value. As an inhalation (added to warm water made alkaline) it has been used as a sedative to allay cough and bronchial spasm.

## PEPPER AND PELLITORY ROOT

These drugs contain alkaloids which are probably closely similar in chemical constitution.

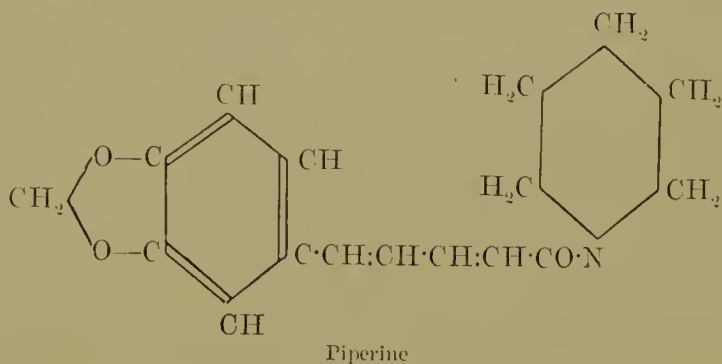
Pepper yields piperine, which is a colourless crystalline substance insoluble in water, but soluble in organic solvents. Its solution possesses a powerful pungent taste.

On heating with caustic alkalies it breaks up into piperidine and piperic acid,





As the constitution of both piperidine and piperic acid and the manner in which these are united are known, the formula of piperine is known. It is as follows :



Pellitory root yields pyrethrine or pellitorine.

Pyrethrine was obtained as an amorphous mass which partially crystallised on cooling. It was said to break up on hydrolisation into piperidine and pyrethric acid. But more recently the purity of this substance has been doubted, and a small quantity of a crystalline substance which has been termed pellitorine has been obtained. On account of the small yield the constitution of this substance could not be determined, but it is apparently a pyridine derivative.

**Piper Nigrum.**—‘The dried unripe fruit of *Piper nigrum*, Linn.’

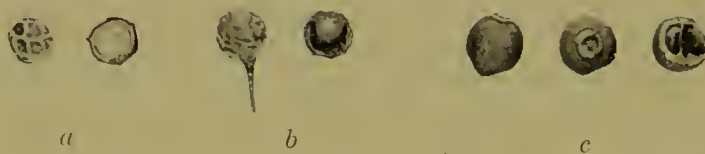


FIG. 12.

(a) Fruit of *Piper nigrum*, showing reticulated pericarp and section (single seed filling cavity); (b) Cubebs; (c) Pimento. Natural size.

**Characters.**—Nearly globular, almost black fruits, deeply and reticulately wrinkled, about  $\frac{1}{8}$  inch in diameter. Each fruit contains a single seed that completely fills the cavity. Odour aromatic; taste pungent.

Cubebs and pimento somewhat resemble black pepper. Cubebs is stalked; pimento is reddish-brown in colour and contains two seeds. The drugs also differ in odour and taste.

**Active Principles.**—**Piperine** (5 to 8 per cent.); a volatile oil (about 2 per cent.).

Chavicine, which hydrolyses to piperidine and chavicic acid; piperidine; and a bitter pungent resin, are said to occur.

The volatile oil consists of phellandrene and sesqui-terpenes.

*Pharmacology*.—Powdered pepper is irritant. If sniffed it produces sneezing; if applied to open wounds it causes a dull burning pain. When taken by the mouth it has a hot pungent taste, and in the stomach and intestines acts as a carminative. This action closely resembles that of a volatile oil (see page 469). It is used mainly as a condiment.

**Confectio Piperis**.—Contains 1 of black pepper in 10, with powdered caraway fruit and honey.

Black pepper, 2; caraway fruit, 3; clarified honey, 15.

*Dose*.—60 to 120 grains.

*Pharmacology*.—It is a useful carminative in flatulence and chronic gastric catarrh, but is comparatively rarely used. It may be employed as a pill-excipient, and is said to be useful in hæmorrhoids and other rectal diseases. It has also been given for chronic urethritis (gleet).

**Pulvis Opii Compositus**. See page 316.

**Pyrethri Radix**—pellitory root. ‘The dried root of *Anacyclus Pyrethrum*, DC.’

*Characters*.—Usually unbranched pieces, nearly cylindrical in shape but tapering slightly towards each end, brown in colour and longitudinally wrinkled, from 3 to 4 inches, occasionally more, in length, and about  $\frac{1}{2}$  inch in thickness. The crown frequently bears a tuft of nearly colourless hairs. The fracture is short, and the fractured surface shows a large, distinctly radiate wood. Microscopically examined, numerous brownish oil-glands are seen scattered in



FIG. 13.

Pellitory root, showing crown with tuft of hairs, and at lower end radiate appearance of section. Natural size.

the bark and wood. The odour is faint but characteristic ; the taste pungent. When chewed it induces a copious flow of saliva.

Compare with dandelion root (page 467), noting especially the appearance of the section.

*Chief Constituents.*—**Pyrethrine** or pellitorine ; resinous substances ; a small amount of volatile oil.

*Pharmacology.*—Its action is similar to that of pepper, but it produces more copious salivation when chewed. It is an ingredient of some dentifrices, and has been used as a masticatory for dryness of the mouth. The tincture (page 43) diluted has been employed as a mouth-wash.

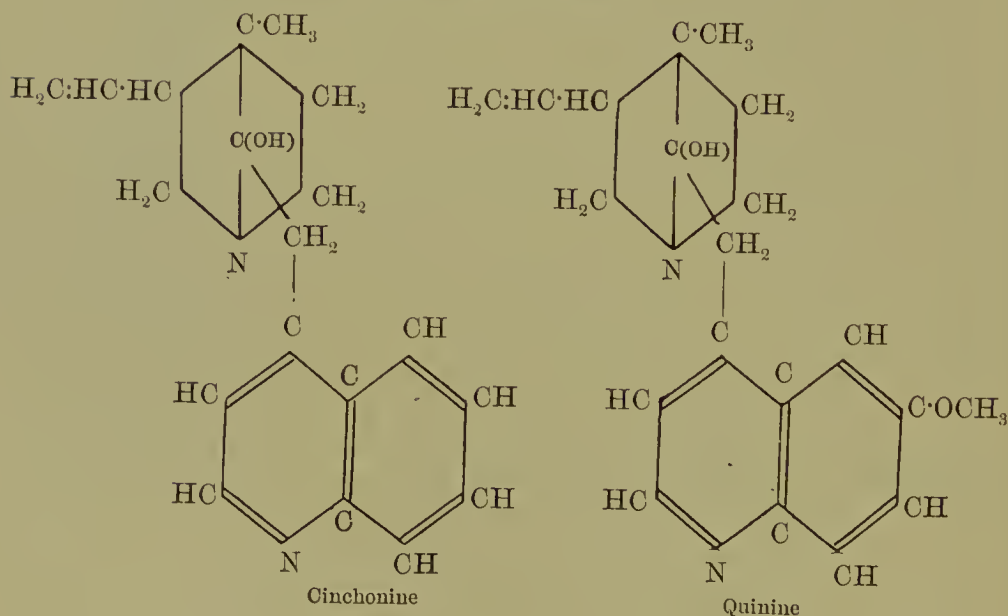
## QUINOLINE DERIVATIVES

The alkaloids of cinchona bark and of nux vomica belong to this group.

### CINCHONA BARK

From various species of cinchona bark a large number (over twenty) of alkaloids have been isolated. Of these, quinine, quinidine, cinchonine, and cinchonidine are the most important.

Quinine is para-methoxy-cinchonine. Cinchonine and therefore quinine contain both a pyridine and a quinoline ring, but the manner in which these are united is not definitely known. The following formulæ are believed to express the constitution best :



*The Pharmacological Action of Quinine.*—The most important actions of quinine are its effects on the lower forms of life, its action on the brain and special senses, and its power of retarding oxidation.

Most protozoa are powerfully affected by it, a solution of 1 in 20,000 rapidly causing paralysis and death. A similar strength of solution stops the amœboid movements of the white blood-corpuscles and causes them to become rounded and coarsely granular. Owing to this action, quinine prevents the diapedesis of leucocytes from the blood-vessels. Quinine is a moderately powerful antiseptic.

Taken by the mouth in doses of  $\frac{1}{4}$  to 1 grain in solution, it acts simply as a bitter (see page 453). In a few people it may cause symptoms of cinchonism, but this is rare. The administration of larger doses (10 to 20 grains) often produces a feeling of heaviness at the epigastrium, and sometimes nausea, vomiting, and diarrhœa; but, if well borne, absorption occurs and is followed by exhilaration, which later gives place to headache, giddiness, and sometimes to deafness, blindness, hallucinations, delirium, and collapse. By many, however, this dose is borne with impunity. The repeated administration of small doses frequently produces a similar series of symptoms. The first to appear are noises in the ears, which are accompanied by more or less deafness, and, if the quinine be continued, by diminution of sight, sometimes blindness, and other serious nervous symptoms. Cutaneous eruptions occasionally occur. This complex is known as quinism or **cinchonism**.

The most important of the other actions of quinine is its antipyretic action. In health the temperature is not influenced except by toxic doses, but in fever 5 to 10 grains will usually cause a fall of temperature of a few degrees for 5 or 6 hours. It is, however, rarely used now as an antipyretic.

Quinine is rapidly absorbed and is also rapidly excreted (the greater part of a moderate dose within 24 hours), mainly in the urine.

The other important alkaloids of cinchona bark have a



similar action to quinine. They differ from it in certain points, and are much less valuable therapeutically.

Quinine is used mainly in the treatment of malaria and malarial conditions, and as a bitter. As an antiseptic it is too expensive for general use, and it possesses no advantages over many other substances. As an antipyretic it has been replaced by newer (synthetic) drugs. It has been employed to contract the uterus both during and after labour, but its action is uncertain.

Its action in malaria is specific. This disease is due to a protozoan-like form—the *Plasmodium malariae*—which undergoes a cycle of changes in the blood, mainly in the red blood-corpuscles. Small spore-like forms penetrate into the red blood-corpuscles, grow and take on amœboid movements, finally segment, and by the disintegration of the blood-corpuscle appear again in the blood-plasma as spores. The period it takes the cycle to occur determines the variety of the malaria; if two days it is tertian, if three, quartan fever. These are the common forms. The malarial attack (rigor &c.) commences with the discharge of the spores into the blood-plasma. Quinine kills these parasites as it kills other protozoan forms.

Probably the best time to administer quinine is 3 to 5 hours before an attack. The attack will not be prevented, but the discharge of spores inaugurating it will occur into quininised blood, and as they are then in the most susceptible condition the following attack will be aborted or greatly diminished in severity. A few large, well-timed doses in the common types of malaria are better than small doses frequently administered. Quinine will also prevent malaria. About 5 grains a day are generally sufficient for this purpose.

As a bitter, small doses—less than 1 grain—are sufficient. These are useful in stimulating the appetite in atonic dyspepsia, chronic gastric catarrh, convalescence, and other conditions.

Quinine is also given in various periodic diseases (neuralgia &c.) probably malarial, whooping-cough, influenza, and as a gastric and intestinal antiseptic.

**Cinchonæ Rubræ Cortex.**—‘The dried bark of the stem and branches of cultivated plants of *Cinchona succirubra*, *Pavon*.’

*Characters.*—Quilled or incurved pieces, often 1 foot or more in length, and  $\frac{1}{2}$  to 2 inches in thickness. Externally, brownish or reddish-brown in colour, except where covered with a greyish lichen, longitudinally wrinkled, and frequently



FIG. 14.

Red Cinchona bark.  $\frac{1}{2}$  linear.

warty and cracked transversely. The bark is usually  $\frac{1}{8}$  to  $\frac{3}{16}$  inch in thickness. The inner surface is brick-red or deep reddish-brown in colour, and irregularly and coarsely striated. The texture is somewhat soft, the fracture somewhat fibrous. It has no distinctive odour, but has a bitter and slightly astringent taste.

*Chief Constituents.*—Quinine, quinidine, cinchonine, cinchonidine, and other less important alkaloids; a bitter glucoside, quinovin; cincho-tannic acid (2 to 4 per cent.); quinic acid (5 to 7 per cent.); and red colouring matter—cinchona red (up to 10 per cent.).

The less important alkaloids are diquinidine, dicinchonine, hydroquinine, hydroquinidine, cinchotine or hydrocinchonine, cinchamidine or dihydrocinchonidine, quinamine, conquinamine, &c., and are collectively termed ‘amorphous alkaloid.’

Quinovin yields, on hydrolysis, a sugar, quinovite, and quinovic acid.

An average specimen of red cinchona bark yields of quinine 1·5 per cent., cinchonidine 2·5 per cent., cinchonine 1·0 per cent., amorphous alkaloids 0·8 per cent.

The Pharmacopœia states that ‘when used for purposes other than that of obtaining the alkaloids or their salts, it

should yield between 5 and 6 per cent. of total alkaloids, of which not less than half should consist of quinine and cinchonidine.' This ensures the absence of disproportionate amounts of cinchonine and amorphous alkaloid.

*Pharmacology.*—The action of cinchona bark is due mainly to the quinine and allied alkaloids it contains. The presence of tannic acid makes it mildly astringent. The red colouring matter gives the preparations a pleasant appearance. It is used as a bitter tonic. In the treatment of malaria and most other diseases it has been superseded by quinine.

**Extractum Cinchonæ Liquidum.**—Contains 5 per cent. of the alkaloids of red cinchona bark.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Powerfully bitter and mildly astringent. It may be used as a bitter tonic in convalescence and chronic gastric diseases; as an astringent in mild diarrhoea; and for neuralgia and malarial conditions, although for these quinine is usually preferred.

**Infusum Cinchonæ Acidum.**—Contains the soluble ingredients of 1 ounce of red cinchona bark, and a little aromatic sulphuric acid in 20 fluid ounces.

Red cinchona bark, 1 oz.; aromatic sulphuric acid, 2 fl. drs.; boiling distilled water, 20 fl. oz.

The acid helps to extract the alkaloids, and gives the infusion a brighter red appearance.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—A pleasant bitter tonic. Used chiefly as an excipient.

**Tinctura Cinchonæ.**—Contains 1 per cent. of the alkaloids of red cinchona bark.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—In pharmacopœial doses its action is that of a bitter, and it is used mainly as such.

**Tinctura Cinchonæ Composita.**—Contains 0·5 per cent. of the alkaloids of the bark, with bitter-orange peel, serpentary rhizome, and colouring matter.

Dried bitter-orange peel, 1 oz.; serpentary rhizome,  $\frac{1}{2}$  oz.; cochineal, 28 grs.; saffron, 55 grs.; tincture of cinchona, 10 fl. oz.; alcohol (70 per cent.), to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is more pleasantly aromatic, but a somewhat weaker bitter than the simple tincture. It is used for the same purposes.

### QUININE SALTS

Three salts of quinine are official. They differ in their solubility in water, but apart from differences dependent on this they all exhibit the same pharmacological action. The sulphate is soluble in about 800 parts of water, the hydrochloride in about 37 parts, and the acid hydrochloride in an equal weight of water. The sulphate is therefore less bitter than the hydrochloride, and the acid hydrochloride is sufficiently soluble in water to enable it to be administered hypodermically if necessary. The action of each is solely dependent on the quinine it contains.

**Quininæ Sulphas.** — ‘The sulphate  $[(C_{20}H_{24}N_2O_2)_2, H_2SO_4] \cdot 15H_2O$ , of an alkaloid obtained from the bark of various species of cinchona and remijia.’

Besides various species of cinchona, quinine is also found in cupræa bark (*Remijia Purdiana*), and any source is legitimate providing the alkaloidal salt conforms to the official tests.

*Characters.*—Light, colourless, silky needles, efflorescing in dry air, with an intensely bitter taste. Soluble in about 800 parts of water, in about 65 parts of 90 per cent. alcohol, and in about 40 parts of glycerin; readily soluble in water acidulated with a mineral acid owing to the formation of an acid salt. Its aqueous solutions have a bluish fluorescence.

Alkalies precipitate quinine from a saturated solution in water; the precipitated quinine is soluble in ether and in excess of ammonia. If, to an aqueous solution, chlorine or bromine water is added, and then solution of ammonia until the precipitate first formed is re-dissolved, an emerald-green colour is produced. (Phenazone, and to a less extent, caffeine and urea, prevent the reaction.)



It should not contain any appreciable amount of cinchonine, quinidine, eupreine, or amorphous alkaloid. Tests for these (somewhat inefficient) are given in the Pharmacopœia. It should not yield more than 3 per cent. of impure cinchonidine when tested by the method given.

When exposed to dry air it effloresces, and the 15 molecules of water of crystallisation become reduced to about 4.

*Dose.*—1 to 10 grains.

*Pharmacology.*—Its action and uses have been described. On account of its comparative insolubility, large doses can be given suspended in water without inconvenience. It is also a better salt than the hydrochloride if its antiseptic action on the intestine is required. Employed as a bitter, it is advisable to convert it into the soluble acid salt by adding a little acid to the prescription.

**Pilula Quininæ Sulphatis.**—Contains  $\frac{5}{6}$  its weight of quinine sulphate.

Quinine sulphate, 30; tartaric acid, 1; glycerin, 4; tragacanth, 1.

*Dose.*—2 to 8 grains.

*Pharmacology.*—A convenient preparation for administering large doses of quinine.

**Tinctura Quininæ Ammoniata.**—Contains nearly 1·5 per cent. of quinine and 1 per cent. of ammonia.

Quinine sulphate, 175 grs.; solution of ammonia, 2 fl. oz.; alcohol (60 per cent.), 18 fl. oz.

The ammonia decomposes the quinine sulphate and liberates quinine, which is dissolved by the alcohol. On adding to water, the quinine is thrown down, because it is very slightly soluble in this medium.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has the combined action of small doses of quinine and ammonia. It is a common domestic remedy for a cold, and is sometimes given in influenza. It is a useful tonic and stimulant.

**Ferri et Quininæ Citras.**—See page 177. The quinine in this preparation plays the part of a bitter.

**Syrupus Ferri Phosphatis cum Quinina et Strychnina.**—See page 172.

**Quininæ Hydrochloridum**— $C_{20}H_{21}N_2O_2, HCl, 2H_2O$ .

*Characters.*—Colourless, silky, acicular crystals with a very bitter taste. Soluble in 37 parts of water, and in 1 part of alcohol.

It should not contain more than traces of sulphates.

*Dose.*—1 to 10 grains.

*Pharmacology.*—It is the most generally useful salt of quinine. Large doses, however, should not be given in solution, as the bitter taste is nauseating to some individuals.

**Tinctura Quininæ.**—A solution of 2 per cent. quinine hydrochloride in tincture of orange.

Quinine hydrochloride, 2 grammes; tincture of orange, 100 c.c.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is a pleasant method of administering quinine hydrochloride. In pharmacopœial doses its action is mainly that of a bitter tonic.

**Vinum Quininæ.**—A solution of 1 grain of quinine hydrochloride in 1 fluid ounce of orange wine.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—Also a pleasant method of administering quinine. It has a bitter action and the action of small doses of alcohol.

**Quininæ Hydrochloridum Acidum**—

$C_{20}H_{24}N_2O_2, 2HCl, 3H_2O$ .

*Characters.*—Small colourless crystals or a white crystalline powder with a powerfully bitter taste. Soluble in less than its weight of water, and in 5 parts of 90 per cent. alcohol. Its solutions are acid.

Each gramme dissolved in 20 c.c. of water requires for neutralisation 2.5 c.c.  $\frac{N}{1}$ NaOH. It should not contain more than traces of sulphates.

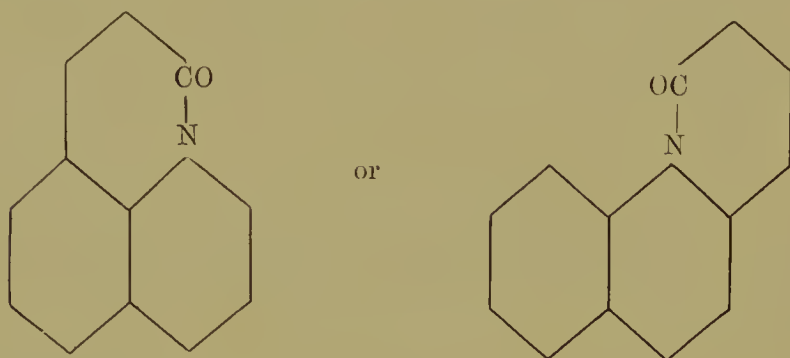
*Dose.*—1 to 10 grains.

*Pharmacology.*—It may be used in place of the other salts of quinine, but is intended mainly for hypodermic injections. It produces some pain on account of its acidity and the action of the quinine, and should therefore be injected deeply into the muscles.

### NUX VOMICA

This drug contains two alkaloids, strychnine and brucine

Brucine,  $C_{23}H_{26}N_2O_4$ , is probably di-methoxy-strychnine. The constitution of strychnine,  $C_{21}H_{22}N_2O_2$ , is not definitely known, but it contains the following group ( $-\text{CO}-\text{N}=\text{}$ ) and very probably a piperidine-like ring, and hence is a quinoline derivative. The ring-system of strychnine is probably as follows:



*Pharmacology of Strychnine.*—It acts chiefly on the nervous system and especially on the spinal cord, and is also a bitter and acts as such; a solution of 1 in 120,000 has an appreciable bitter taste.

After small doses ( $\frac{1}{100}$  grain) taken by the mouth it acts mainly as a bitter, but if these are repeatedly administered the individual feels brighter, the senses become more acute, and there is an increased capacity for work.

After larger doses ( $\frac{1}{20}$  to  $\frac{1}{10}$  grain) there is a feeling of restlessness, increased reflex activity, and more or less anxiety. Sight and hearing are more acute, there is muscular stiffness, and may be tremors or even convulsions.

Still larger doses ( $\frac{1}{2}$  grain) produce a similar series of symptoms but more severe. The anxiety is painful, respiration is embarrassed, and convulsions soon occur. They usually appear suddenly; the body becomes stiff, the back arched

(opisthotonus), and respiration ceases. Death may occur in the paroxysm, but usually after some seconds relaxation follows and the individual appears normal but exhausted. After a variable interval a second convulsion develops, and this may be followed by a third or even a number. Death, however, commonly occurs early and results from respiration failing to re-establish itself after a convulsion; it may occur later from exhaustion. Consciousness is usually maintained until near the end.

The convulsions are of spinal origin. They are not spontaneous, but are due to afferent impulses producing an exaggerated effect owing to the increased sensitiveness and diminished resistance in the paths of the spinal cord. All reflex arcs are affected. The medullary centres are also apparently stimulated, and after moderate doses the respiration is increased in depth, the heart somewhat slowed, and the blood-pressure rises slightly.

The other actions of strychnine are comparatively unimportant. It appears to have a tonic influence on the intestine and is a useful remedy in the treatment of chronic constipation.

It is rapidly absorbed from the alimentary canal, and most of it is rapidly excreted, mainly in the urine.

It is used largely as a bitter and general tonic. It is also employed in various nervous affections, especially paralyses, but is contra-indicated in acute nervous diseases.

*Brucine* has a similar action to strychnine, but, as a convulsant, is only about one-fortieth as powerful. As the amount in *Nux Vomica* may exceed that of strychnine, the necessity of standardising the preparations of this drug to a definite amount of strychnine instead of total alkaloids is obvious. The taste of brucine, however, excels in bitterness that of strychnine.

**Nux Vomica.**—‘The dried ripe seeds of *Strychnos Nux-vomica*, *Linn.*’

*Characters.*—Disc-shaped seeds, usually with a somewhat thickened margin, flat or more or less bent, ash-grey or



greenish-grey in colour, and covered with short silky appressed hairs;  $\frac{3}{4}$  to 1 inch in diameter, and about  $\frac{1}{4}$  inch in thickness. A raised line running from a small prominence at

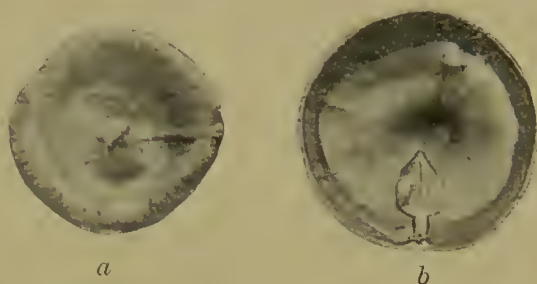


FIG. 15.

Nux-vomica seeds. (a) shows raised line passing from central hilum to periphery. (b) Seed divided (after soaking in water) to show small leafy cotyledon. Natural size.

the periphery to the central hilum is usually to be seen on one surface. They have no odour, but a very bitter taste.

The endosperm is large and horny. If soaked in water the seeds are readily cut, and on sagittal section display two small leafy cotyledons.

*Chief Constituents.*—**Strychnine** (0·7 to 1·5 per cent.); **brucine**. Total alkaloid, usually 2 to 3 per cent.

A small amount of a glucoside, loganin, and igasuric (caffeo-tannic) acid also occur.

*Dose, in powder.*—1 to 4 grains.

*Pharmacology.*—Its action is due to the strychnine and brucine it contains. It is rarely used in the form of powder.

**Extractum Nucis Vomicae Liquidum.**—Contains 1·5 per cent. of strychnine.

*Dose.*—1 to 3 minims.

*Pharmacology.*—It may be used for obtaining the effects of strychnine, but is employed almost solely in making the following preparations.

**Extractum Nucis Vomicae.**—Contains 5 per cent. of strychnine.

*Dose.*— $\frac{1}{4}$  to 1 grain.

*Pharmacology.*—It has a somewhat slower action than the other preparations containing strychnine. It

is used when it is desired to administer this alkaloid as a pill, and is most commonly employed in combination with other remedies for chronic constipation.

**Tinctura Nucis Vomicae.**—Contains 0·25 per cent. of strychnine.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action is mainly that of the strychnine it contains. The action of the brucine, apart from its bitter taste, is practically negligible. It is commonly used when the action of strychnine is required, but it possesses no advantages over Liquor Strychninae Hydrochloridi, except that it is more compatible with alkalies.

**Strychnina.**—‘An alkaloid,  $C_{21}H_{22}N_2O_2$ , obtained from the dried ripe seeds of *Strychnos Nux-vomica*, *Linn.*, and other species of *Strychnos*.’

*Characters.*—Colourless prismatic crystals, without odour, but with a very bitter taste. Soluble in 7,000 parts of water, in 150 parts of alcohol, and in 6 parts of chloroform; only slightly soluble in ether.

If a small quantity is dissolved in a few drops of sulphuric acid and a particle of potassium bichromate added, a bluish-violet coloration results, which passes through a reddish colour to a dirty green or yellow. It gives only a yellowish coloration with nitric acid (distinction from brucine). It should contain no brucine or mineral ash.

*Dose.*— $\frac{1}{60}$  to  $\frac{1}{15}$  grain.

*Pharmacology.*—See page 298. It may be used when it is desired to administer strychnine in the form of a pill, but it is official mainly to make the following preparation.

**Syrupus Ferri Phosphatis cum Quinina et Strychnina.**—One fluid drachm contains the equivalent of 1 grain of anhydrous ferrous phosphate,  $\frac{1}{5}$  grain of quinine sulphate, and  $\frac{1}{32}$  grain of strychnine.

Prepared by dissolving iron wire in slightly diluted phosphoric acid, adding strychnine and quinine sulphate, and filtering into syrup.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is mainly that of strychnine. The quinine sulphate increases its bitter action; the iron phosphate plays a subordinate part. It is useful in debility and in various conditions (neuralgia, &c.) arising from this.

### **Strychninæ Hydrochloridum—**

$C_{21}H_{22}N_2O_2, HCl, 1\frac{1}{2}H_2O$ .

*Characters.*—Small colourless prismatic or acicular crystals, with a powerfully bitter taste. Soluble in 35 parts of water, and in 60 parts of 90 per cent. alcohol. Its solutions are neutral.

It should not contain any sulphate.

*Dose.*— $\frac{1}{60}$  to  $\frac{1}{15}$  grain.

Used almost solely in the form of the liquor.

**Liquor Strychninæ Hydrochloridi.**—A 1 per cent. solution of strychnine hydrochloride in 22 per cent. alcohol.

Strychnine hydrochloride, 1 g.; alcohol (90 per cent.), 25 c.c.; distilled water, to make 100 c.c.

*Dose.*—2 to 8 minims.

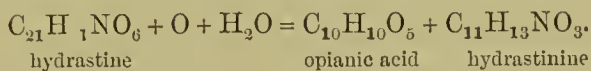
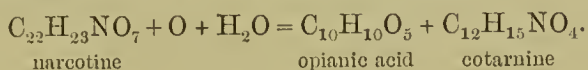
*Pharmacology.*—See page 298. It is employed as a bitter tonic in various gastric and debilitated conditions. It is also used, hypodermically or by the mouth, in various forms of paralyses of a chronic nature not due to an incurable central lesion. It is used in the treatment of alcoholism and drug habits, and in heart disease when digitalis is contra-indicated.

## ISO-QUINOLINE GROUP

This group contains some of the less important alkaloids of opium—papaverine, narceine, narcotine, &c.—and the alkaloids of *Hydrastis canadensis*—hydrastine and berberine.

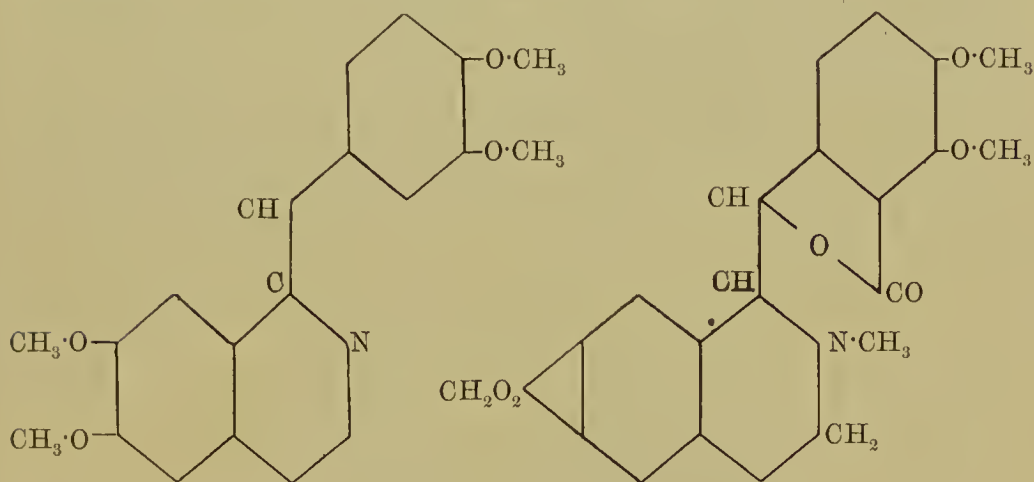
Papaverine is tetra-methoxybenzyl-isoquinoline. The constitution of narceine is not definitely known, but its probable formula is given below.

Berberine is of little pharmacological importance (for formula see page 590). Narcotine and hydrastine are closely related, narcotine being methoxy-hydrastine. On treatment with oxidising agents (dilute nitric acid) both alkaloids break up into similar products:



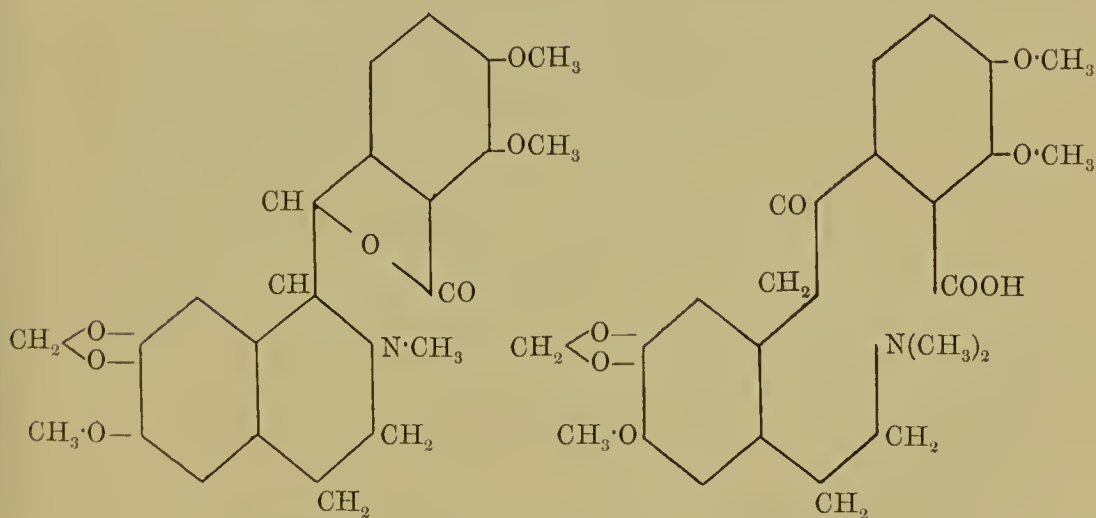
These reactions are of some importance, as hydrastinine and a derivative of cotarnine are employed in therapeutics.

The following arrangement, showing the relationship of the natural alkaloids, is taken from Schmidt (page 159):



Papaverine

Hydrastine



Narcotine

Narceine



## HYDRASTIS RHIZOME

**Hydrastis Rhizoma.**—‘The dried rhizome and roots of *Hydrastis canadensis*, *Linn.*’

*Characters.*—Yellowish-brown tortuous pieces,  $\frac{1}{2}$  to  $1\frac{1}{2}$  inches long, and about  $\frac{1}{4}$  inch thick. From the so-called upper surface ascending branches arise which are marked with the scars of cataphyllary leaves and usually terminate in a cup-shaped depression. From the sides and under surface numerous thin brittle roots are given off. The fracture is short; and the smooth fractured surface is distinctly yellowish in colour. The drug has a slight characteristic odour and a bitter taste.

*Chief Constituents.*—**Hydrastine** (1.5 to 4 per cent.); berberine (3 to 4 per cent.); canadine (tetra-hydro-berberine); volatile oil; resin (small quantities of each).



FIG. 16.

Hydrastis rhizome. Showing under surface, with numerous roots, and upper surface with short ascending branches. Natural size.

*Pharmacology.*—Its action is mainly that of the hydrastine it contains. Berberine gives it a bitter taste, and hence a bitter action. Canadine is present in amounts too small to be of importance.

Hydrastine acts upon the medulla oblongata and spinal cord, and upon muscular tissue. In small doses it stimulates

the medullary centres and produces contraction of blood-vessels, slight slowing of the heart, and increase in respiration. Larger doses produce convulsions similar to those of strychnine. These, however, are soon modified by a depressant action on the muscles themselves.

The heart is slowed and weakened both by a central action and an action on the cardiac muscle. The contraction of the blood-vessels is mainly if not solely of medullary origin. The parturient uterus is said to be contracted, but this is doubtful.

Hydrastine is absorbed and excreted, mainly in the urine, unchanged.

It is used chiefly in uterine hæmorrhage, especially that due to endometritis or no obvious lesion. It is of little service in post-partum hæmorrhage, or the hæmorrhage of uterine fibroids or cancer. It has been used as a bitter tonic in atonic dyspepsia and other conditions, and has been employed as a local application to chronically inflamed mucous membranes.

**Extractum Hydrastis Liquidum.** — Contains the active ingredients of 1 ounce of rhizome in 1 fluid ounce.

*Dose.*—5 to 15 minims.

**Tinctura Hydrastis.**—Contains the active ingredients of 1 ounce of rhizome in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

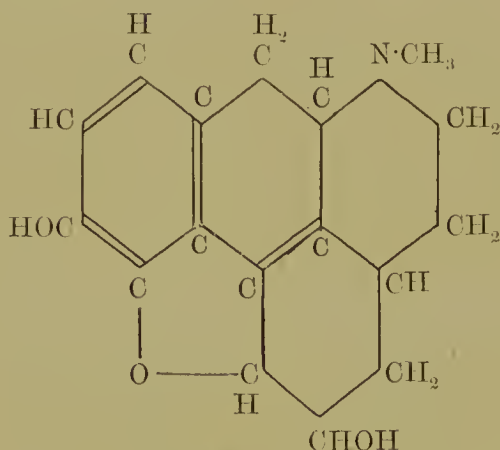
There is little to choose between the two preparations ; either may be employed.

**Hydrastinine** is more frequently administered than either hydrastine or the preparations of hydrastis. This alkaloid has a more powerful action on the medullary centres, especially the vaso-motor centre, and a much less depressant action on the heart. It is not official.

## PHENANTHRENE DERIVATIVES

The alkaloids belonging to this group are morphine, codeine, and thebaine, all occurring in opium, and an artificial alkaloid, apomorphine, prepared from morphine.

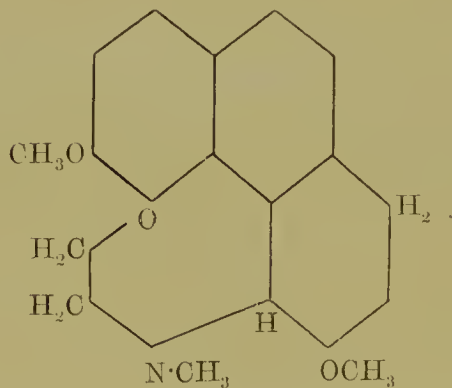
Morphine,  $C_{17}H_{19}NO_3$ , is a derivative of tetra-hydro-phenanthrene. The nitrogen atom probably occurs in a reduced pyridine or pyrrolidine ring, and one oxygen atom—the so-called ‘indifferent oxygen’—probably forms a bridge between two benzene rings of the phenanthrene nucleus. The other two oxygen atoms occur in an alcoholic and a phenolic hydroxyl respectively. Pschorr’s formula, slightly modified, is given as being the most probable one.



Morphine

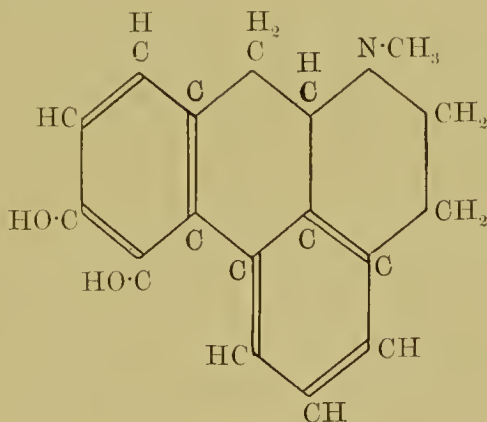
Codeine,  $C_{18}H_{21}NO_3$ , is methyl-morphine. It contains a methyl radical in place of the hydrogen of the phenolic hydroxyl.

Thebaine,  $C_{19}H_{21}NO_3$ , is a di-hydro-phenanthrene derivative, and two oxygen atoms occur as methoxyls, the other being the so-called indifferent oxygen. The formula given (Pschorr's) is the most recent, but it is unsatisfactory, especially as regards the ring containing the oxygen and nitrogen.



Thebaine

Apomorphine,  $C_{17}H_{17}NO_2$ , contains two atoms of hydrogen and one of oxygen less than morphine. Both the oxygens it contains occur in phenolic hydroxyl groups.



Apomorphine

*Pharmacological Action of Morphine.*—Its main action is a depressant one on the brain.

After small doses ( $\frac{1}{8}$  to  $\frac{1}{6}$  grain) there is often a temporary increase of mental and bodily vigour, which is followed by dulness and disinclination for work, diminution of sensibility, drowsiness, and, if taken in the evening, usually sleep. There may be slight perspiration. The sleep is apparently normal and is of variable duration, but generally lasts 6 to 8 hours. Slight dulness is felt on awakening. If sleep does not occur a sense of calmness is usually experienced.

After larger doses ( $\frac{1}{2}$  grain) drowsiness and sleep quickly follow. The sleep is heavy and the individual can be only partially aroused. Respiration is slower than normal and the skin is somewhat flushed and moist. The sleep lasts 8 to 12 hours, and on awakening there is a feeling of dulness, dryness of the mouth, and often nausea. Headache and vomiting are also common, and constipation almost invariably results.

After doses of 1 grain or more, sleep rapidly occurs, and gradually deepens into coma. The patient is aroused with difficulty, and again becomes unconscious as soon as the stimulation ceases. The respiration is notably slow and may become irregular, the skin is moist and flushed, but may be



pale, the pulse is usually somewhat full and regular, and the pupils are markedly contracted ('pin-point pupils'). The patient may recover or may sink into complete unconsciousness from which he cannot be aroused. The respiration then becomes irregular and shallow, the pulse irregular and weak, the skin markedly cyanotic, and death occurs from paralysis of the respiratory centre.

The most important points in the pharmacology of morphine are its effect in relieving pain, its action on the respiratory centre, its action on secretions, and the tolerance and habit to which it may lead. It has comparatively little effect on the circulation.

Apart from general anæsthetics, morphine is by far the most powerful drug for relieving pain. A small dose insufficient to produce an apparent general action will relieve mild irritation, and if severe pain is present it can usually be pushed until the pain is relieved without inducing serious general effects. It acts on the recipient centres in the brain. When locally applied it depresses the sensory nerve-endings to a slight degree, but insufficiently to be of much practical value.

The respiratory centre is markedly depressed by morphine, and this forms one of the most serious objections to the use of the drug.

It diminishes all secretions, with the exception of the urine and the sweat. Thus the nasal discharge occurring during a coryza is temporarily stopped; the bronchial secretion may be diminished; constipation is induced. But the effect is not due simply to diminished secretory activity. In the case of the constipation, for example, peristalsis is diminished and plays a greater part in effecting the condition than the diminution of the intestinal secretions.

When repeatedly administered, morphine gradually loses its power of producing its characteristic effects. An increase in the dose is necessary to obtain them, and this dose, in turn, becomes inefficient, and has to be enlarged. By gradual increments the dose which may finally be taken is enormous. A tolerance, or, in the case of self-administration, a habit, is

said to have been acquired. In these cases the morphine appears to undergo more rapid and complete decomposition in the body (blood?) than under normal conditions. The tolerance, however, in some respects, is limited. Sooner or later the habit of taking morphine (or opium) produces a more or less definite series of symptoms which are collectively known as **morphinism**. The individual shows well-marked mental perversion; he is often particularly untruthful regarding the habit of taking the drug, and, on account of the intense craving for it, will endeavour to acquire it by any means in his power. Sleeplessness, hallucinations, bodily and mental weakness, even tremors and ataxia are common. The mouth is dry, there is loss of appetite, often nausea and vomiting, and usually constipation. The skin is dry and shrivelled, the pupils are contracted, impotence and sterility are frequent, and there are often symptoms associated with the heart, respiration, or kidneys. If the drug is taken hypodermically, puncture marks may be seen, and small subcutaneous abscesses are not uncommon.

After single doses morphine frequently produces ill-effects in many people. It sometimes fails to induce sleep and may produce nausea and vomiting instead. Headache, vesical irritation, itching of and eruptions on the skin, and more serious symptoms may occur.

Morphine is rapidly absorbed, a portion undergoes some unknown change in the body, but the larger part of a single dose is excreted by the lower portion of the intestines.

It is used mainly to relieve irritation and pain, to induce sleep if pain is present, to diminish or annul peristalsis, to procure restfulness (in hæmoptysis, &c.) and to relax spasm. It is useful in diabetes and certain other conditions.

Weakly children bear morphine badly. It is also a dangerous remedy in acute bronchitis with profuse bronchial secretion.

*Codeine*, like morphine, has a depressant action on the brain, but it is much less powerful than morphine. It is also much less depressant to the medullary centres. In animals,

in frogs especially, well-marked convulsions resembling those produced by strychnine are obtained after the administration of large doses.

*Thebaine* has a similar action to strychnine. It does not cause cerebral depression, but convulsions, which are due to an action on the spinal cord. It is not employed therapeutically.

*Apomorphine* is an emetic. After  $\frac{1}{10}$  grain hypodermically it causes vomiting in a few minutes, and practically no other symptoms than those associated with the act of vomiting. The nausea is well marked and apt sometimes to be prolonged. When taken by the mouth in  $\frac{1}{10}$  grain doses it may produce some nausea, but it acts mainly as an expectorant, increasing and rendering less tenacious the bronchial mucus; and as a diaphoretic, increasing the quantity of sweat secreted. Its emetic action is due to stimulation of the vomiting centre in the medulla oblongata. This is evident from the fact that larger doses are required to produce vomiting, and that it takes much longer to act when given by the mouth than when administered hypodermically.

#### POPPY CAPSULES

**Papaveris Capsulæ.**—‘The nearly ripe dried fruits of *Papaver somniferum*, *Linn.*’

*Characters.*—They vary considerably in shape and size, being rounded, oval, or somewhat flattened, and often 3 inches in diameter. They are very light; pale yellowish-brown in colour, often marked with dark spots; crowned by stellately arranged stigmas and sharply contracted below into a neck. On section, a number of thin brittle parietal placentas, and a large number of small yellowish, reticulated, reniform seeds, lying for the most part free in the cavity, are seen. The capsules have no odour, but the pericarp has a bitter taste.

The variety of poppy yielding black seeds (maw seed) is not official.

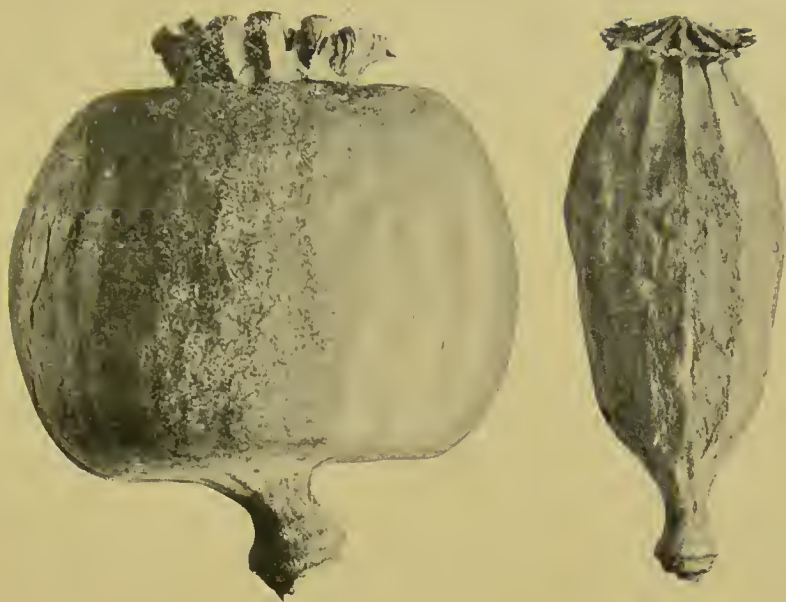


FIG. 17.

Poppy capsules, showing difference of shape.  $\frac{3}{4}$  linear.

*Chief Constituents.*—**Morphine** (0·1 to 0·25 per cent.). Meconic acid. The seeds contain no morphine, but yield about 50 per cent. of fixed oil.



FIG. 18.

Capsule transversely cut, showing parietal placentas.  $\frac{3}{4}$  linear.

*Pharmacology.*—They have a slight and variable action, dependent on the morphine they contain. They are only used to make fomentations, which are believed to exert a



sedative effect, to apply to bruises, &c. The most active factor in such applications is the moist heat. They are little used by the medical profession.

### OPIUM

**Opium.**—‘The juice obtained by incision from the unripe capsules of *Papaver somniferum*, *Linn.*, inspissated by spontaneous evaporation.’

The capsule of the poppy contains an interlacing system of laticiferous vessels, which are richest in latex when the capsules are unripe. They are incised at this period, and the exuded white milky juice is scraped off, collected into a mass, and dried in the sun. In the process of drying it changes to a dark-brown colour.

The mode of incising the capsules varies in different countries. A single transverse incision (see fig. 19) is sometimes employed, but more than one incision, made simultaneously or at different times, and oblique and vertical incisions are used.



FIG. 19.

Poppy capsule, showing terminations of a single horizontal incision.  $\frac{3}{4}$  linear.

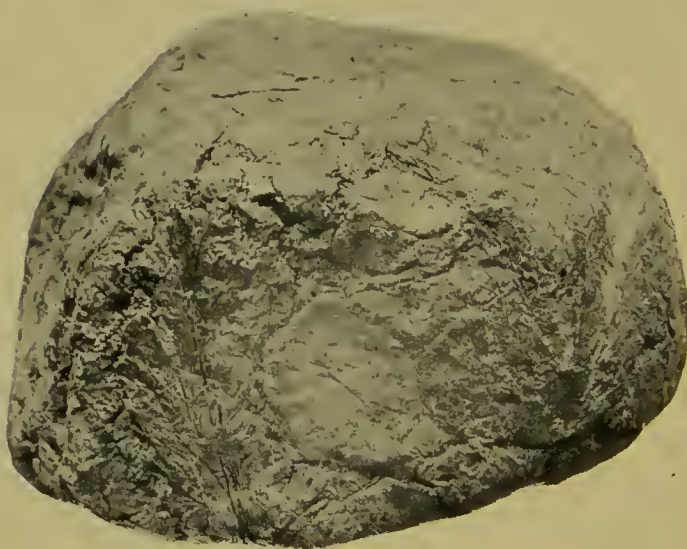


FIG. 20.

Constantinople opium. The midrib of the enveloping poppy leaf is seen a little to the left of the centre. The piece weighed  $1\frac{1}{2}$  lbs.  $\frac{2}{3}$  linear.

The incisions are often made by a scarificator to avoid penetrating too deeply the wall of the capsule.

The form in which opium is exported from different countries also varies. Turkey opium, the kind most commonly met with in this country, occurs in flattened irregular masses, weighing from  $\frac{1}{2}$  to 2 lbs., covered with a poppy leaf (Constantinople opium), the midrib of which is usually conspicuous (see fig. 20), or with the seeds of a species of *Rumex* ( Smyrna opium). Persian opium is exported as somewhat conical masses, weighing about 12 oz., or in short sticks, wrapped in paper. Other varieties (Indian, Chinese, &c.) are rarely met with.

*Characters.*—Irregularly rounded or flattened masses, enveloped in a poppy-leaf or in large seeds, usually weighing from  $\frac{1}{2}$  to 2 lbs. Internally reddish-brown and plastic when fresh, but becoming darker and drier by keeping. The odour is characteristic, the taste bitter.

*Chief Constituents.*—**Morphine** (4 to 20 per cent.); narcotine (anarcotine) (0·75 to 9 per cent.); codeine (0·3 to 2 per cent.); thebaine (0·15 to 0·4 per cent.). The morphine occurs combined as sulphate and meconate. Meconic acid (about 5 per cent.) is important because its reaction with solutions of ferric salts affords a ready means of detecting opium.

Opium contains twenty-one alkaloids, three neutral principles, three organic acids (meconic, lactic, acetic), and indifferent matter (sugar, fats, mineral salts, &c.). The alkaloids (most of which occur in very small quantities) are, besides those given above—Papaverine, Narceine, Cryptopine, Pseudo-morphine, Laudanine, Laudanosine, Lanthopine, Protopine, Codamine, Tritopine, Hydrocotarnine, Gnoscopine, Oxynarcotine, Papaveramine, Laudanidine, Meconidine, Xanthaline. The neutral principles are—Meconin, Meconiasin, Opionin.

Owing to the variability in the composition of opium, the Pharmacopœia specifies a certain standard. For making preparations which are standardised during the process of manufacture, opium containing, when dry, **not less than 7·5 per cent.** of morphine must be used. For all other preparations anhydrous opium containing from **9·5 to 10·5 per cent.** of morphine must be employed.

The reason for giving a minimum limit of morphine in the case of opium used in making standardised preparations is that opium containing less morphine than this usually contains excessive quantities of other alkaloids (narcotine especially), the presence of which is undesirable.

The opium used for making other preparations must, if weaker in morphine than 9·5 to 10·5 per cent., be brought up to standard strength by the addition of an opium containing more than the official strength of morphine. If stronger than is officially required, it must be diluted with an inferior quality of opium or with milk-sugar. Good Turkey opium yields from 13 to 18 per cent. of morphine.

*Dose.*— $\frac{1}{2}$  to 2 grains.

*Pharmacology.*—Its action is mainly that of the morphine it contains; the action of the other alkaloids is of little importance. It differs from morphine in being absorbed more slowly, hence its effects are somewhat later in appearing, and last correspondingly longer; and it also exerts a relatively greater effect upon the intestinal canal. It is said to produce nausea more readily in some people.

It is used for the purposes already summarised (page 309). Being absorbed more slowly than morphine, it is generally preferred to this when an intestinal effect, or a more gentle and prolonged action, as in the treatment of cough, is required.

The preparations of opium are numerous. They include four powders, three pills, three tinctures, one extract, one liquid extract, one plaster, liniment, suppository, and ointment.

All the preparations are standardised. The liquid preparations are standardised during the process of making, or are prepared from standardised preparations. The solid preparations are made from standardised opium (see page 313).

**Extractum Opii.**—A so-called aqueous extract containing 20 per cent. of morphine.

It is obtained of proper strength and consistence by mixing stronger and weaker extracts, or by dilution with distilled water or with milk sugar.

*Dose.*— $\frac{1}{4}$  to 1 grain.

*Pharmacology.*—Its action and uses are the same as those of opium. It is administered in the form of a pill, and is given when a slow and prolonged action is required. Its advantages over opium are its definite percentage of morphine and the absence of inert insoluble substances.

**Extractum Opii Liquidum.**—Contains 0·75 per cent. of morphine.

*Dose.*—5 to 30 minims.

*Pharmacology.*—Its action is the same as that of tincture of opium, and it may be used whenever the action of opium is required. It is employed most frequently to induce sleep in cases in which opium is indicated.

**Tinctura Opii**—laudanum. Contains 0·75 per cent. of morphine.

*Dose.*—5 to 15 minims for repeated administration ; 20 to 30 minims for a single administration.

*Pharmacology.*—It is the preparation of opium most generally used, and may be given whenever the action of this drug is required.

**Tinctura Camphoræ Composita**—paregoric. A tincture containing 0·046 per cent. (about  $\frac{1}{40}$  grain in 1 fluid drachm) of morphine. It also contains benzoic acid and camphor, and is flavoured with oil of anise.

Tincture of opium, 585 minims ; benzoic acid, 40 grs. ; camphor, 30 grs. ; oil of anise, 30 minims ; alcohol (60 per cent.), to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has a mild opium action. It is used mainly in the treatment of bronchial affections (cough, &c.), in which cases its sedative action is aided by the stimulant action of the benzoic acid, camphor, and oil of anise, on the bronchial mucous membrane. It is not unpleasant to take, and is consequently the best preparation of opium to administer to children.

**Tinctura Opii Ammoniata.**—Contains 0·11 per cent. (nearly  $\frac{1}{16}$  grain in 1 fluid drachm) of morphine ; benzoic acid ; oil of anise ; and solution of ammonia.

Tincture of opium, 3 fl. oz. ; benzoic acid, 180 grs. ; oil of anise, 60 minims ; solution of ammonia, 4 fl. oz. ; alcohol (90 per cent.), to make 20 fl. oz.



*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It combines the sedative effects of opium with the stimulant action of ammonia and benzoic acid. It is used in the treatment of whooping cough and bronchial affections, and as a sedative and hypnotic in heart disease. Although the dose is the same as paregoric, it should be noted that it is a more powerful preparation.

**Linimentum Opii.**—Consists of equal volumes of tincture of opium and liniment of soap. It contains 0.375 per cent. of morphine.

*Pharmacology.*—It is at first stimulant, then mildly sedative. It is used in the treatment of bruises, rheumatic joints, muscular rheumatism, &c., but is little better than liniment of soap alone.

**Pilula Saponis Composita.**—Contains 20 per cent. of opium.

Opium, 1; hard soap, 3; syrup of glucose, 1.

*Dose.*—2 to 4 grains.

*Pharmacology.*—It is a convenient preparation for administering opium under a disguised name.

**Pilula Plumbi cum Opio.**—Consists of lead acetate 6; opium 1; syrup of glucose  $\frac{2}{3}$ .

*Dose.*—2 to 4 grains.

*Pharmacology.*—A powerful constipating pill; used in severe cases of diarrhœa.

**Pulvis Opii Compositus.**—Contains 10 per cent. of opium. The remainder consists almost solely of aromatic substances.

Opium,  $1\frac{1}{2}$ ; black pepper, 2; ginger, 5; caraway fruit, 6; tragacanth,  $\frac{1}{2}$ .

The various ingredients, except the last, can be detected by the smell.

*Dose.*—2 to 10 grains.

*Pharmacology.*—The aromatic substances act as carminatives and counteract the tendency of the opium to derange digestion. It is not much used, but it may be employed in the treatment of diarrhœa with colic.

**Pulvis Ipecacuanhæ Compositus.**—Dover's powder. Consists of ipecacuanha root 1; opium 1; potassium sulphate 8.

The potassium sulphate acts merely as a diluent.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It has mainly the action of opium modified slightly by the presence of ipecacuanha. Thus it is less constipating than opium, and is also a more marked diaphoretic. It is largely used to induce slight sweating after a chill, and is also useful in the treatment of diarrhœa and vomiting. It may be employed to produce an opium action in other conditions.

**Pilula Ipecacuanhæ cum Scilla.**—Contains about 5 per cent. of opium and of ipecacuanha root, and about 17 per cent. of squill and of ammoniacum.

Compound powder of ipecacuanha, 3; squill, 1; ammoniacum, 1; syrup of glucose, a sufficient quantity.

*Dose.*—4 to 8 grains.

*Pharmacology.*—It is mainly of use in bronchial affections. All the active ingredients influence bronchial secretion, and opium allays cough and irritation.

**Pulvis Kino Compositus.**—Consists of kino 15; opium 1; cinnamon bark 4.

*Dose.*—5 to 20 grains.

*Pharmacology.*—It is employed mainly in the treatment of diarrhœa. Kino is a moderately powerful intestinal astringent; cinnamon bark is mildly astringent, but is mainly flavouring and carminative; the opium acts as a sedative and aids in the constipating effect.

**Pulvis Cretæ Aromaticus cum Opio.**—Consists of opium 1; aromatic powder of chalk 39.

*Dose*.—10 to 40 grains.

*Pharmacology*.—It is slightly more constipating than aromatic powder of chalk. The opium, however, acts mainly as a sedative. It is one of the best official preparations for the treatment of diarrhœa in children.

**Emplastrum Opii**.—Contains 10 per cent. of opium.

Opium, 1 ; resin plaster, 9.

*Pharmacology*.—It is questionable if the opium has any action. It has been employed in lumbago and allied conditions, but is rarely used.

**Suppositoria Plumbi Composita**.—Each suppository contains 1 grain of opium and 3 grains of lead acetate.

Lead acetate, 3 ; opium, 1 ; oil of theobroma, 12.

*Pharmacology*.—Mainly astringent and sedative to the lower part of the rectum ; also somewhat sedative to the adjacent pelvic organs. The opium is absorbed by the rectal mucous membrane, and produces a mild general effect. The suppositories are used chiefly in the treatment of inflammation and irritable conditions of the lower part of the rectum.

**Unguentum Gallæ cum Opio**.—Contains  $7\frac{1}{2}$  per cent. of opium and  $18\frac{1}{2}$  per cent. of powdered galls.

Opium, 1 ; gall ointment,  $12\frac{1}{3}$ .

*Pharmacology*.—An astringent and sedative ointment. It is used mainly in the treatment of external piles ; it may also be used for fissure of the anus.

#### SALTS OF MORPHINE

Morphine itself is not official, but three of its salts—the hydrochloride, tartrate, and acetate—are official. These differ in their solubility in water, but their pharmacological action is practically the same. The hydrochloride is somewhat more powerful than the acetate or tartrate, because it contains

relatively more morphine in its molecule than these, but the difference is small. All the salts have the same dose ( $\frac{1}{8}$  to  $\frac{1}{2}$  grain); they all have a liquor of 1 per cent. strength and 10 to 60 minim dose as a preparation. Most of the other preparations are made from the hydrochloride, but the hypodermic injection is made from the tartrate, because the hydrochloride is not sufficiently soluble in water. The commercial acetate varies in solubility, and in solution is somewhat unstable.

**Morphinæ Hydrochloridum.**—‘The hydrochloride,  $C_{17}H_{19}NO_3 \cdot HCl \cdot 3H_2O$ , of an alkaloid obtained from opium.’

*Characters.*—Colourless silky crystals or micro-crystalline powder, with a very bitter taste. Soluble in 24 parts of water, in 50 parts of alcohol, and in 8 parts of glycerin; insoluble in ether. Its solutions are neutral.

A solution gives, on addition of a dilute solution of ferric chloride (freshly prepared), a greenish-blue coloration (King’s blue). If moistened with nitric acid the salt yields an orange-red coloration, which gradually becomes more yellow. Sulphuric acid dissolves it without coloration, but the addition of a small quantity of sodium arsenate causes a bluish-green coloration, or a small quantity of bismuth oxynitrate causes a bluish-brown coloration.

*Dose.*— $\frac{1}{8}$  to  $\frac{1}{2}$  grain.

*Pharmacology.*—Its action and uses have been described (page 307). It is the salt of morphine most commonly employed, and it is to be preferred to opium or its preparations except in conditions already specified (page 314). It is somewhat more rapid in its action than opium, and is less liable to produce nausea and constipation.

**Liquor Morphinæ Hydrochloridi.**—A dilute alcoholic solution containing 1 per cent. of morphine hydrochloride.

Morphine hydrochloride, 1 g.; diluted hydrochloric acid, 2 c.c.; alcohol (90 per cent.), 25 c.c.; distilled water, to make 100 c.c.

*Dose.*—10 to 60 minims.

*Pharmacology.*—It is a convenient solution for administering morphine hydrochloride.



**Suppositoria Morphinae.**—Each suppository contains  $\frac{1}{4}$  grain of morphine hydrochloride.

Morphine hydrochloride,  $\frac{1}{4}$  grain; oil of theobroma, 15 grains.

*Pharmacology.*—They have a mildly sedative action on the lower part of the rectum, but are used mainly to obtain the general action of morphine, when for any reason it is not advisable to give this drug by the mouth. The morphine hydrochloride is readily absorbed by the rectal mucous membrane.

**Trochiscus Morphinae.**—Each lozenge contains  $\frac{1}{36}$  grain of morphine hydrochloride. Tolu basis.

*Pharmacology.*—It is a convenient preparation for administering small doses of morphine. The lozenges are used mainly in the treatment of cough.

**Trochiscus Morphinae et Ipecacuanhae.**—Each lozenge contains  $\frac{1}{36}$  grain of morphine hydrochloride and  $\frac{1}{12}$  grain of powdered ipecacuanha root. Tolu basis.

*Pharmacology.*—These are generally more efficacious in the treatment of bronchial cough than the simple morphine lozenges on account of the ipecacuanha they contain (see page 340).

**Tinctura Chloroformi et Morphinae Composita.**—Contains in 10 minims— $\frac{3}{4}$  minim of chloroform,  $\frac{1}{2}$  minim of dilute hydrocyanic acid,  $\frac{1}{11}$  grain of morphine hydrochloride, 1 minim tincture of Indian hemp,  $\frac{1}{4}$  minim tincture of capsicum. It is flavoured with oil of peppermint.

Chloroform, 7·5 c.c.; morphine hydrochloride, 1 g.; diluted hydrocyanic acid, 5 c.c.; tincture of capsicum, 2·5 c.c.; tincture of Indian hemp, 10 c.c.; oil of peppermint, 0·15 c.c.; glycerin, 25 c.c.; alcohol (90 per cent.), to make 100 c.c.

The tincture appears greenish in colour when seen by transmitted light. It has the characteristic smell of chloroform and oil of peppermint.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action is mainly that of morphine. The other ingredients are chiefly sedative and carminative. It is used in the treatment of flatulence, colic, diarrhoea, and bronchial cough.

**Morphinæ Tartras**— $(C_{17}H_{19}NO_3)_2, C_4H_6O_6, 3H_2O$ .

*Characters.*—A colourless crystalline powder, with a very bitter taste. Soluble in 11 parts of cold water, very slightly soluble in alcohol.

It gives the reactions of morphine previously described, but the coloration obtained with solution of ferric chloride is not so distinct as in the case of morphine hydrochloride.

*Dose.*— $\frac{1}{8}$  to  $\frac{1}{2}$  grain.

*Pharmacology.*—Practically the same as that of the other official salts of morphine. It contains slightly less morphine than equal weights of the hydrochloride or the acetate.

**Liquor Morphinæ Tartratis.**—A dilute alcoholic liquor containing 1 per cent. of morphine tartrate.

Morphine tartrate, 1 g.; alcohol (90 per cent.), 25 c.c.; distilled water, to make 100 c.c.

*Dose.*—10 to 60 minims.

*Pharmacology.*—A convenient solution for administering morphine tartrate.

**Injectio Morphinæ Hypodermica.**—A 5 per cent. aqueous solution of morphine tartrate.

Morphine tartrate, 5 g.; distilled water, recently boiled and cooled, to make 100 c.c.

*Dose, by subcutaneous injection.*—2 to 5 minims.

*Pharmacology.*—It is used when a rapid effect is required, as in acute pain; and in other conditions when it is inadvisable to administer morphine by the mouth.

**Morphinæ Acetas**— $C_{17}H_{19}NO_3, C_2H_4O_2, 3H_2O$ .

‘The carefully dried salt obtained by neutralising morphine with acetic acid.’

*Characters.*—A colourless crystalline powder, with a faint acetous odour and a very bitter taste. Soluble in about  $2\frac{1}{2}$  parts of water, and in about 100 parts of alcohol. It loses acetic acid when exposed to the air, and becomes less soluble in water.

It gives the reactions characteristic of morphine (see page 319). Two grammes treated as directed by the Pharmacopœia should yield 1.42 grammes of residue (morphine). This quantitative test is important, because the salt decomposes on exposure to air and then yields a larger percentage of morphine.

*Dose.*— $\frac{1}{8}$  to  $\frac{1}{2}$  grain.

*Pharmacology.*—Its action and uses are the same as those of the other salts of morphine. It is more soluble than these, and is sometimes used in strong solution as a hypodermic injection when large doses of morphine are required.

**Liquor Morphinæ Acetatis.** — A dilute alcoholic solution containing 1 per cent. of morphine acetate.

Morphine acetate, 1 g.; diluted acetic acid, 2 c.c.; alcohol (90 per cent.), 25 c.c.; distilled water, to make 100 c.c.

*Dose.*—10 to 60 minims.

*Pharmacology.*—Its action and uses are the same as those of the other morphine liquors.

## CODEINE

**Codeina.**—‘An alkaloid,  $C_{17}H_{18}(CH_3)NO_3, H_2O$ , obtained from opium or from morphine.’

*Characters.*—Colourless crystals, having a slightly bitter taste. Soluble in 80 parts of water, in 2 parts of alcohol or chloroform, and in 30 parts of ether; also soluble in about 80 parts of Liquor Ammoniæ. Its aqueous solution is alkaline.

Its solutions do not give the characteristic bluish colour with dilute solution of ferric chloride obtained with morphine. It also yields a yellow colour only when treated with nitric acid. It differs from morphine also in being more soluble in solution of ammonia than in solution of caustic potash.

When dissolved in excess of sulphuric acid and gently warmed it assumes a bluish-black colour on the addition of a minute quantity of

ammonium molybdate, ferric chloride, or potassium ferricyanide, which is changed to a bright scarlet, turning to orange, on the addition of a trace of nitric acid.

*Dose.*— $\frac{1}{4}$  to 2 grains.

*Pharmacology.*—This has been referred to (page 309). It is used mainly for relieving cough, especially of phthisis, and in the treatment of diabetes. It may also be used to relieve irritation of various kinds. It is less liable than morphine to constipate, and it has also a much less depressant action on the respiratory centre.

**Codeinæ Phosphas**— $C_{17}H_{18}(CH_3)NO_3, H_3PO_4, 1\frac{1}{2}H_2O$ .

*Characters.*—Colourless crystals with a slightly bitter taste. Soluble in 4 parts of water, slightly soluble in alcohol.

Its aqueous solutions have a faintly acid reaction. They yield a whitish precipitate with solution of potassium hydroxide, but not with solution of ammonia.

It should contain no chlorides, sulphates, or morphine.

*Dose.*— $\frac{1}{4}$  to 2 grains.

*Pharmacology.*—Similar to that of codeine. Being more soluble in water, it often acts more quickly, but is somewhat more transient in its action, partly on account of its greater solubility, and partly because it only contains  $\frac{3}{4}$  of its weight of codeine. It is used for the same purposes as codeine.

**Syrupus Codeinæ.**—Contains  $\frac{1}{4}$  grain of codeine phosphate in 1 fluid drachm (nearly 0.5 per cent.).

Codeine phosphate, 40 grs.; distilled water,  $\frac{1}{4}$  fl. oz.; syrup,  $19\frac{3}{4}$  fl. oz.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—It is a pleasant and convenient preparation for administering codeine phosphate, especially in the treatment of cough.

#### APOMORPHINE HYDROCHLORIDE

**Apomorphinæ Hydrochloridum.** — ‘The hydrochloride,  $C_{17}H_{17}NO_2, HCl$ , of an alkaloid obtained by heating



morphine hydrochloride or codeine hydrochloride in sealed tubes with hydrochloric acid.'

*Characters*.—Small greyish-white acicular crystals, with a bitter taste. Soluble in 50 parts of water, somewhat more soluble in alcohol. The salt and its solutions assume a greenish colour on exposure to light and air. If solutions are boiled, the change quickly occurs. The Pharmacopœia says that 'if the salt impart an emerald-green colour to 100 parts of water after shaking the mixture, it should be rejected.'

Nitric acid gives with it a blood-red coloration. A dilute solution of ferric chloride added to a solution gives a deep-red colour. A solution of sodium bicarbonate added to a solution of the salt preëcipitates the base, which, being less stable than the salt, becomes greenish on standing; the addition of a few drops of an alcoholic iodine solution quickly changes this to a purer green colour, and, if the mixture be shaken with ether, the ether is coloured purplish. If to about 20 drops of a 1 per cent. solution 4 drops of 0·3 per cent. solution of potassium dichromate are added, and the mixture shaken for a half to one minute, it assumes a dark-green colour, and imparts to acetic ether, when shaken with it, a violet colour; if to this 5 drops of 1 per cent. stannous chloride are added, the solution becomes green.

*Dose*.— $\frac{1}{20}$  to  $\frac{1}{10}$  grain, by hypodermic injection; by the mouth,  $\frac{1}{10}$  to  $\frac{1}{4}$  grain.

*Pharmacology* (see page 310). In small doses given by the mouth it is a useful expectorant in acute and some chronic cases of bronchitis, and is especially useful for children. It is given hypodermically as an emetic in the form of the official injection.

**Injectio Apomorphinæ Hypodermica.** — Contains 1 per cent. of apomorphine hydrochloride.

Apomorphine hydrochloride. 0·1 g.; diluted hydrochloric acid, 0·1 e.e.; distilled water, recently boiled and cooled, 10 e.e.

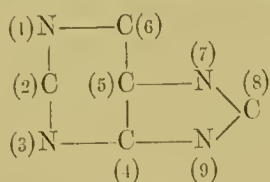
*Dose, by subcutaneous injection*.—5 to 10 minims.

*Pharmacology*.—It is a convenient solution for administering apomorphine hypodermically. It is used to induce vomiting in cases of poisoning; but in narcotic poisoning its action is often delayed, and larger doses may be required.

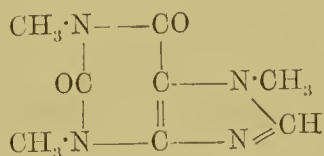
## PURINE DERIVATIVES

The only official representative of this group is caffeine.

Caffeine is 1,3,7-trimethyl-2,6-dioxypurin or 1,3,7-trimethyl-xanthine.



Purine ring



Caffeine

Purine itself is of no practical importance, but its derivatives—uric acid, the xanthines, and hypoxanthines—are both of physiological and pathological interest. The only derivatives of therapeutical importance, besides caffeine, are theobromine (3,7-dimethyl-2,6-dioxypurine, or 3,7-dimethyl-xanthine), which occurs in cocoa (1 to 2 per cent.), and theophylline (1,3-dimethyl-2,6-dioxypurine or 1,3-dimethyl-xanthine), which occurs along with caffeine in tea. Theophylline is now prepared synthetically, and used as a substitute for caffeine.

## CAFFEINE.

**Caffeina** — theine. ‘An alkaloid,  $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2\cdot\text{H}_2\text{O}$ , usually obtained from the dried leaves of *Camellia Thea*, *Link*, or the dried seeds of *Coffea arabica*, *Linn*.’

Tea yields 2·5 to 4·0 per cent., and coffee 1 to 1·5 per cent.

*Characters*.—Colourless, silky, acicular crystals, with a slightly bitter taste. Soluble in 80 parts of water, in 40 parts of alcohol, and in 7 parts of chloroform; very slightly soluble in ether. Its solutions are neutral to litmus.

Caffeine may be volatilised without decomposition. Its solutions do not give a precipitate with Mayer's reagent (potassio-mercuric iodide), and the precipitate produced by tannic acid is soluble in excess. It gives no coloration with sulphuric or nitric acids; but if decomposed by adding a crystal of potassium chlorate and a few drops of hydrochloric acid and evaporated to dryness, a reddish residue remains, which becomes purple when moistened with ammonia (murexide).

*Dose*.—1 to 5 grains.

*Pharmacology*.—It stimulates the central nervous system, the kidneys, and muscular tissue. The effect it produces

varies in different individuals—a result due, in part, to tea and coffee being used as beverages to a varying extent.

After 2 or 3 grains, fatigue and drowsiness usually disappear, and there is an increased capacity for mental exertion, the pulse is commonly accelerated, and diuresis follows. After larger doses, there is usually headache, restlessness, and sleeplessness, often palpitation, and sometimes precordial anxiety, tremors, and other serious symptoms. After still larger doses, nausea and vomiting, excitement and mild delirium, and, later, symptoms of collapse with irregular pulse may occur. Recovery follows.

Besides the higher centres of the brain, the medullary centres are also stimulated. Respiration is quickened and deepened, and the blood-vessels are contracted. The contraction of the blood-vessels, however, is due in part to a direct action on their walls. The heart is stimulated, owing mainly to a direct action on the cardiac muscle, and the blood-pressure is raised. As a result of the increased blood-pressure and a stimulant action on the renal cells, the quantity of urine secreted is increased. Caffeine also stimulates voluntary muscle.

It is absorbed as such, but is partly de-methylised during its passage through the body, and is excreted in the urine as dimethyl-xanthine, mono-methyl-xanthine, and xanthine (most of which is probably converted into urea). Only a small portion is excreted unchanged.

It is used as a stimulant in heart disease, and as a diuretic in cardiac dropsy. It sometimes relieves attacks of migraine, and is a useful stimulant in narcotic poisoning (opium, alcohol). (In the form of tea and coffee it is commonly employed to remove nervous exhaustion.)

**Caffeinæ Citras.**—‘An unstable compound,  $C_8H_{10}N_4O_2, C_6H_8O_7$ , prepared from caffeine and citric acid.’

*Characters.*—A white powder, with an acid and faintly bitter taste. Soluble in 3 parts of water. The further addition of more water dissociates the salt, and caffeine is precipitated. It re-dissolves when sufficient water is added to make a 1 in 32 solution of the dissociated salt.

*Dose*.—2 to 10 grains.

*Pharmacology*.—Owing to its dissociation its action is that of citric acid (which is negligible) and of caffeine. It contains half its weight of caffeine, and consequently its dose is twice as great as that of the alkaloid. It may be used for the same purposes.

**Caffeinæ Citras Effervescens**.—An effervescing preparation containing 4 per cent. of caffeine citrate.

Caffeine citrate, 4; tartaric acid, 27; citric acid, 18; sodium bicarbonate, 51; sugar, 14.

*Dose*.—60 to 120 grains.

*Pharmacology*.—It is merely a pleasant method of administering caffeine. The sodium tartrate and citrate formed have a slight diuretic action.

**Theobromine** is a somewhat more powerful diuretic than caffeine, but it has practically no influence on the circulation or central nervous system.

**Theophylline** has a similar action.

## DRUGS CONTAINING ALKALOIDS OF UNKNOWN CONSTITUTION

Some of the alkaloids considered under this head have been stated to belong to the pyridine or quinoline groups, but the evidence is as yet unsatisfactory, and they are consequently left unclassified. Of the constitution of some of the alkaloids we know practically nothing.

The group includes the alkaloids of aconite root, of stavesacre seeds, of gelsemium root, of lobelia, of Calabar bean, of ipecacuanha root, of colchicum corm and seeds, of pomegranate bark, of cusparia bark, of broom, of pareira root, of serpentary root, and veratrine.

## ACONITE

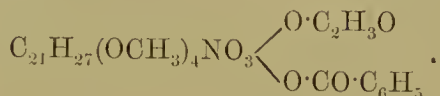
The dried root and its active principle, aconitine, are official.



Aconitine, a crystalline alkaloid, is easily hydrolysed (by boiling with water) into acetic acid, benzoic acid, and aconine.



It is therefore acetyl-benzoyl-aconine. It contains four methoxyl ( $\text{CH}_3\text{O}$ ) groups, and has been stated to be a quinoline derivative. Its formula might be written :



Other varieties of aconite contain alkaloids (pseudaconitine, japaconitine, &c.) as active ingredients, which are closely similar to, but not identical with, aconitine.

*Pharmacological Action of Aconitine.*—It first stimulates, then depresses, sensory nerve-endings; it stimulates and afterwards depresses the medullary centres; after somewhat larger doses it exerts a depressant action on the cardiac muscle.

A 2 per cent. ointment when rubbed into the skin produces local tingling and diminished tactile sensation, which lasts some hours. A weak solution (a drop of 1 in 1,000) applied to the tip of the tongue also produces persistent tingling.

When taken by the mouth in solution, small doses ( $\frac{1}{500}$  grain) have a slightly bitter taste, and cause warmth and slight tingling of the buccal and pharyngeal mucous membranes, followed by slight warmth in the epigastrium and slowing of the pulse. After larger doses ( $\frac{1}{100}$  to  $\frac{1}{50}$  grain) there is marked tingling in the mouth, throat, and stomach, followed by tingling all over the body, nausea and vomiting, more or less marked dyspnoea, and a slow, later weak irregular pulse. The skin is pale, cold, and moist, and the pupil is frequently dilated. Much larger doses are lethal. The symptoms of collapse are more marked, but consciousness is usually retained until near the end. The tingling sensation disappears, the heart and respiration become weak and irregular, and convulsions frequently precede death, which occurs from respiratory failure. After very large doses death quickly results, and probably arises, in the main, from paralysis of the heart.

After therapeutic doses the main action is upon the medullary centres. These are primarily stimulated, and there is consequently quickening of the respiration and slowing of the heart. This latter action largely masks the effect on the vaso-motor centre. It is questionable if therapeutic doses exert a distinct action on the cardiac muscle itself.

Aconitine is not absorbed under ordinary circumstances from the skin, but it is quickly absorbed from the alimentary canal, and is excreted mainly in the urine.

**Benz-aconine** and **aconine**, which are decomposition products of aconitine and are also found in aconite root, are of no practical importance.

**Aconiti Radix.**—‘The root of *Aconitum Napellus*, *Linn.* collected in the autumn from plants cultivated in Britain, and dried.’

*Characters.*—More or less conical in shape, dark brown in colour, with a somewhat smooth surface, but marked by the remains of broken rootlets or the whitish scars left by them; from 2 to 4 inches in length and  $\frac{1}{2}$  to  $\frac{3}{4}$  inch in diameter at the upper extremity. The crown terminates in an undeveloped bud. The fracture is short, and the section shows a white starchy interior, which is seen to consist of a thick cortex, and a stellate pith showing in the upper portions five to seven projecting angles. It has no distinctive odour, but, on chewing, produces persistent tingling and numbness in the mouth.



FIG. 21.

Aconite root, showing old and new root.  
The sections show the stellate pith.  
Natural size.

Old roots are more or less wrinkled, show the remains of the stem at the crown, and often show cavities on section. They are not official.

*Chief Constituents.*—**Aconitine** (about 0·03 per cent.), benzaconine, aconine. Total alkaloid, about 0·07 per cent. The alkaloids are probably combined with aconitic acid.

The amount of alkaloid in aconite root undoubtedly varies at different times of the year and in plants grown in different localities. Hence the Pharmacopœia specifies that the root shall be collected in autumn from plants cultivated in Britain. It is the newly formed (daughter) root which is official, since it must show an undeveloped bud at the crown. This is believed to be the richest in aconitine. The attempt is thus made to obtain some degree of uniformity in the drug.

**Linimentum Aconiti.**—Contains the active principles of 2 ounces of aconite root and a little camphor in 3 fluid ounces.

Aconite root, 2 oz.; camphor,  $\frac{1}{10}$  oz.; alcohol (90 per cent.), to make 3 fl. oz.

*Pharmacology.*—When painted on the skin it produces tingling, followed by more or less numbness. It is used to paint over superficial neuralgias; it may also be employed, combined with other liniments, to relieve the pain of chronic rheumatism and similar conditions.

**Tinctura Aconiti.**—Contains the active principles of 1 ounce of aconite root in 20 fluid ounces.

*Dose.*—5 to 15 minims; if very frequently repeated, 2 to 5 minims.

*Pharmacology.*—Its action is that of the aconitine it contains. It is the preparation usually given when the action of aconite is required; aconitine is rarely administered internally. It is sometimes beneficial in neuralgia. It is given by some physicians in the early stages of some acute inflammatory diseases, in erysipelas, pneumonia, tonsillitis, &c., but it requires to be used with care and discrimination. In the febrile affections of young children, especially those of a nondescript character, it is of greater value. Half to 1 minim given every hour for a short time will often reduce the fever and improve the other symptoms.

**Aconitina.**—‘An alkaloid obtained from aconite root, and having the formula  $C_{33}H_{45}NO_{12}$ .’

The formula generally accepted is that previously given— $C_{34}H_{47}NO_{11}$ .

*Characters.*—Small, colourless crystals. Very slightly soluble in water, readily soluble in chloroform, soluble in about 40 parts of alcohol or ether.

Melting point,  $196^{\circ}$  to  $197^{\circ}C$ . (it appears to vary with the rate of heating; the Pharmacopœia gives  $189^{\circ}$  to  $190^{\circ}C$ .). An alcoholic solution of the alkaloid is dextro-rotatory. If an aqueous solution is faintly acidulated with acetic acid, and a few drops of solution of potassium permanganate added, a red crystalline precipitate is deposited. Aconitine forms crystalline salts.

*Pharmacology.*—See page 328. It is rarely given internally.

**Unguentum Aconitinæ.**—Contains 2 per cent. of aconitine.

Aconitine, 1; oleic acid, 8; lard, 41.

*Pharmacology.*—See page 328. It is mainly employed in the treatment of superficial neuralgias.

## VERATRINE

This alkaloid closely resembles aconitine in some of its actions and is therefore best considered here.

**Veratrina.**—‘An alkaloid, or mixture of alkaloids, prepared from cevadilla, the dried ripe seeds of *Schœnocaulon officinale*, *A. Gray*.’

A process by which it may be obtained is given in the Pharmacopœia.

*Characters.*—A white or light-grey amorphous powder, with an intensely acrid taste. Almost insoluble in water; soluble in 3 parts of alcohol or of chloroform, in 6 parts of ether, and in about 80 parts of olive oil. It dissolves readily in dilute acids with the exception of traces of resinous matter which are often present.

Dissolved in hydrochloric acid and heated on a water-bath for ten to fifteen minutes, it gives a cherry-red colour which is permanent for some

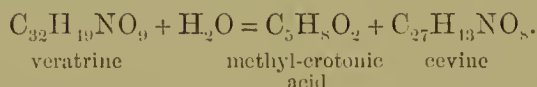


days. With sulphuric acid it gives an intense yellow colour which passes through orange and blood-red to a cherry-red. It yields with nitric acid a yellow solution. See page 265.

*Constituents.*—The official veratrine is a mixture of alkaloids. It consists of **Veratrine** (Cevadine), Veratridine, Cevadilline, Sabadine, Sabadinine.

The nomenclature of the alkaloids has unfortunately been confused.

*Pure Veratrine*, the cevadine of Wright, is a crystalline substance which is decomposed, by treatment with alcoholic potash, into a base, cevine, and an acid, angelic acid, which is transformed by a secondary reaction into methyl-crotonic (tiglic) acid—



*Veratridine*,  $\text{C}_{37}\text{H}_{53}\text{NO}_{11}$ , the veratrine of Couerbe and of Wright, is an amorphous base, but forms crystalline salts. It gives on hydrolysis verine (homologous, possibly identical, with cevine) and dimethyl-protocatechuic acid.

*Cevadilline* is amorphous. *Sabadine* and *Sabadinine* are crystalline.

*Pharmacology.*—Its action on man closely resembles that of aconitine, but it is much less toxic. If rubbed into the skin in the form of an ointment it produces tingling and slight numbness. It is very irritating to mucous membranes, a minute quantity if sniffed causing violent sneezing; and has a persistently bitter and intensely acrid taste.

After absorption it produces at first stimulation and then depression of the medullary centres, but is less powerful than aconitine. It appears, however, to be less readily absorbed than aconitine, and, after large doses, produces more marked gastro-intestinal irritation. It also affects the cardiac muscle to a greater extent. It is excreted slowly, mainly in the urine.

It has a curious effect on frogs, producing prolonged contracture of the muscles. This effect has not been observed in man and it is not evident in other mammals.

Veratrine is used only in the form of an ointment.

**Unguentum Veratrinæ.**—Contains 2 per cent. of veratrine.

Veratrine, 1; oleic acid, 4; lard, 45.

*Pharmacology.*—Its action is the same as, but less powerful than, that of aconitine ointment. It is used for the same purpose.

#### STAVESACRE SEEDS

The dried ripe seeds contain several alkaloids, the most important of which is delphinine. This alkaloid has a similar action to aconitine, but is much less powerful.

**Staphisagriæ Semina.**—Stavesacre seeds. ‘The dried ripe seeds of *Delphinium Staphisagria*, *Linn.*’

*Characters.*—Irregularly triangular or somewhat quadrangular in shape, blackish-brown (when fresh) or dull greyish-brown in colour, markedly wrinkled and pitted. On section they show a whitish, oily interior. They have no distinctive odour, but have a bitter, acrid taste.



FIG. 22.

*Chief Constituents.* — **Delphinine** ( $C_{31}H_{49}NO_7$ ); **delphisine** ( $C_{31}H_{49}NO_7$ ); **delphinoidine** ( $C_{42}H_{68}N_2O_7$  ?); **staphisagroine** ( $C_{40}H_{46}N_2O_7$ ). Total alkaloid about 1 per cent. The seeds contain about 30 per cent. of a **fixed oil**.

Stavesacre seeds; also section of seed showing oily endosperm. Natural size.

*Pharmacology.*—Its action is somewhat similar to, but weaker than, that of aconite root. The seeds are used only in the form of the official ointment.

**Unguentum Staphisagriæ.**—Contains 2 of seeds in  $11\frac{1}{2}$ .

Stavesacre seeds, 2; benzoated lard,  $8\frac{1}{2}$ ; yellow beeswax, 1. After digesting the seeds in the lard, the mixture is strained through calico.

*Pharmacology.*—It is used only as a parasiticide in the treatment of pediculi on the skin. It has been stated that the fixed oil is the active parasitic principle, but this is probably incorrect. The ointment contains the alkaloids both in solution in the lard and in the suspended fine particles of the seeds which are present. It is not much used and is an unnecessary preparation.

## GELSEMIUM ROOT

Gelsemium root contains two alkaloids, gelsemine and gelseminine, which have unfortunately been confused.

Gelsemine,  $C_{22}H_{26}N_2O_3$  or  $C_{21}H_{25}N_2O_4$ , is a crystalline substance without any distinct action on mammals.

Gelseminine,  $C_{12}H_{17}N_3O_{11}$ ?, is an amorphous substance, and forms amorphous salts. It is doubtful if it has been obtained pure. It is pharmacologically active, and produces symptoms resembling those obtained from coniine.

**Gelsemii Radix.**—‘The dried rhizome and roots of *Gelsemium nitidum*, *Michaux*.’

*Characters.*—The commercial drug consists usually of the rhizome and larger roots cut into lengths of about 6 inches.



FIG. 23.

Gelsemium root. Natural size.

The rhizome occurs in nearly cylindrical pieces,  $\frac{1}{2}$  to  $\frac{3}{4}$  inch in thickness, purplish-brown in colour or marked with a network of purplish lines, often much fissured, and sometimes with small roots and aerial stems attached. The root is generally thinner, slightly tortuous, yellowish-brown in colour, and finely wrinkled. The fracture of both is splintery; the transverse section shows a thin cortex and a distinctly radiate yellowish wood. The odour is slightly aromatic, the taste bitter.

The rhizome on fracture shows silky fibres in the bast.

*Chief Constituents.*—**Gelseminine**, an amorphous alkaloid; **gelsemine**, a crystalline alkaloid.

$\beta$ -methyl-esculetin occurs, but is only of interest because it gives a bluish-green fluorescence when dissolved in weak alkaline solutions.

*Pharmacology*.—Its action is almost solely that of the gelseminine it contains. Gelseminine when administered to animals produces gradually increasing muscular weakness accompanied by tremors, which, at first, occur only on movement; by marked dyspnœa, and dilatation of the pupil. Death occurs from failure of the respiration and is usually preceded by weak asphyxial convulsions.

Large doses of a gelsemium preparation have produced in man gastric discomfort, giddiness, muscular weakness, dilatation of the pupils, double vision, and dyspnœa. Consciousness was retained.

Applied to the eye, solutions of gelseminine cause irritation followed by dilatation of the pupil, which commences in about twenty minutes, reaches its maximum in six to seven hours, and lasts about two days. It has been employed for this purpose, but its use has been abandoned.

**Tinctura Gelsemii**.—Contains the active principles of 1 ounce of drug in 10 fluid ounces.

*Dose*.—5 to 15 minims.

*Pharmacology*.—Moderate doses produce double vision in some individuals, and somewhat larger doses cause muscular weakness.

It has been employed in a number of diseases, but now its use is almost confined to the treatment of neuralgia. It is often beneficial, but it often fails. It is sometimes useful in migraine.

## LOBELIA

**Lobelia**.—Indian tobacco. ‘The dried flowering herb of *Lobelia inflata*, *Linn.*’

*Characters*.—The herb is often very much broken. The most characteristic features are the appearance of the stem and the inflated capsules. The stem in its lower portions is quadrangular and channelled and often purplish; above, it is



hairy and winged. It is marked by the remains or the scars of alternate leaves. The capsules are two-celled and when mature contain minute brown reticulated seeds. The odour is somewhat irritating; the taste, after chewing, acrid and burning.

The leaves are from 1 to 3 inches in length, ovate, irregularly toothed, and hairy.

*Chief Constituents.* — **Lobeline**; a small quantity of a volatile oil.

Lobeline,  $C_{15}H_{23}NO_2$ , is a yellow viscid liquid which forms crystalline salts. It is probably a pyridine derivative.

Lobelia also contains a crystalline neutral substance, inflatin, which is pharmacologically inactive, and an acid, lobelic acid.

*Pharmacology.*—The action of lobeline closely resembles that of nicotine. The most evident symptoms produced by it are vomiting and dyspnœa. The respiratory centre is first stimulated, then depressed. The heart is first slowed, then quickened.

When the crude drug is swallowed in large doses, vomiting may be the only symptom produced, but frequently there is abdominal pain, diarrhœa, difficult respiration, a weak pulse, marked depression, and, later, unconsciousness. Convulsions usually precede death.

Its uses are few. It has been given in a number of conditions without much benefit. In bronchial asthma it is said to be useful sometimes, if pushed. It is usually administered in the form of the official tincture.



FIG. 24.

Lobelia. Upper portion of the dried herb, showing capsules.  $\frac{1}{2}$  linear.

**Tinctura Lobeliæ Ætherea.**—Contains the active principle of 1 ounce of crude drug in 5 fluid ounces of spirit of ether.

*Dose.*—5 to 15 minims.

## CALABAR BEAN

**Physostigmatis Semina**—Calabar Bean. ‘The ripe seeds of *Physostigma venenosum*, *Balfour*.’

*Characters.*—Large reddish-brown or chocolate-brown, hard, oblong-reniform seeds, about 1 inch long,  $\frac{3}{4}$  inch broad, and  $\frac{1}{2}$  inch thick, with a dark broad groove, in the centre of



FIG. 25.

Calabar Bean; showing various surfaces and appearance of longitudinal section. Natural size.

which is a fine furrow, running along the convex margin and round one end of the seed. On section the testa is seen to contain two large white cotyledons which, owing to shrinkage during drying, enclose between them a large lenticular cavity. On this account the seeds float when placed in water. The seeds have no characteristic taste or odour.

*Active Principles.*—**Physostigmine**, sometimes called eserine (0·1 to 0·25 per cent.). Iso-physostigmine.

Physostigmine,  $C_{15}H_{21}N_3O_2$ , is crystalline, but is unstable in solution. Very little is known of its constitution. Iso-physostigmine is an isomeride, and differs in being less soluble in ether and in a few other points. It has a similar pharmacological action to physostigmine (see page 340). An alkaloid, calabarine, antagonistic in pharmacological action to physostigmine, was believed to be present, but it has not been found by recent workers.

*Pharmacology*.—Its action is that of the physostigmine it contains (see below). The quantity of this is somewhat variable, some samples containing practically none. The beans were used as ‘ordeal beans’ in West Africa, to judge the guilt or innocence of victims.

**Extractum Physostigmatis**.—An alcoholic extract.

An alcoholic extraction evaporated to a very soft consistence and mixed with three times its weight of milk sugar.

*Dose*.— $\frac{1}{4}$  to 1 grain.

*Pharmacology*.—Its action depends on the physostigmine it contains, which is a variable quantity. It is an unnecessary preparation.

**Physostigminæ Sulphas**—eserine sulphate. ‘The sulphate  $(C_{15}H_{21}N_3O_2)_2 \cdot H_2SO_4 \cdot xH_2O$ , of an alkaloid obtained from Calabar bean.’

The water of crystallisation indicated in the pharmacopœial formula is probably hygroscopic water.

*Characters*.—Small colourless or slightly yellowish deliquescent crystals or micro-crystalline powder, without odour but with a bitter taste. Soluble in less than its weight of water or of alcohol. Its solutions are neutral. Both the crystals and the solutions become red on exposure to air and light.

The colour change occurs rapidly if the solutions are made alkaline. If solution of ammonia is added to the salt and the mixture evaporated to dryness on a water-bath, a bluish residue is left which dissolves in alcohol with the formation of a blue colour. The addition of excess of acetic acid changes this to a fluorescent dichroic solution which is red by reflected and violet by transmitted light. A drop of sulphuric acid added to the bluish residue mentioned above produces a greenish colour which, on the addition of alcohol, becomes reddish, and again greenish after the evaporation of the alcohol. The contraction of the pupil observed after the application of a dilute aqueous solution is the best confirmatory test.

*Dose*.— $\frac{1}{60}$  to  $\frac{1}{20}$  grain.

*Pharmacology*.—The action of physostigmine is somewhat similar to that of pilocarpine. It stimulates secretory glands and causes contraction of unstriated muscle; but it differs from

pilocarpine in its action on the central nervous system and the vascular system, and in being much more powerfully antagonistic to atropine.

Taken in toxic doses it produces distressing vomiting followed by excessive muscular weakness, diarrhoea, salivation, and perspiration, usually contracted pupils, dyspnoea, &c. Death occurs from failure of respiration.

The muscular weakness or paralysis is the most noticeable feature of physostigmine poisoning. It is due to a depressant action on the brain and spinal cord. The vomiting and diarrhoea are due mainly to a stimulant action on the unstriated muscle of the stomach and bowel, the perspiration and salivation to an action on the secretory glands. Physostigmine produces less secretion than pilocarpine, mainly because it causes contraction of blood-vessels and thus diminishes the blood supply. Its action on the heart is somewhat similar to that of pilocarpine.

Physostigmine sulphate is used almost solely to apply to the eye. If a drop of a 1 per cent. solution is applied to the eye the pupil begins to contract in 10 to 15 minutes, it reaches its maximal contraction in 30 to 45 minutes, and, after remaining stationary for a few hours, the effect gradually passes away and the eye is practically normal after 12 hours. Accommodation is usually affected. There is, first, approximation of the 'near point,' and, later, more or less spasm of accommodation which is usually painful. This effect begins later and passes away much earlier than the contraction of the pupil (myosis). Owing to the myosis the intra-ocular tension is diminished.

Physostigmine solutions (0.5 per cent. of sulphate) are employed in the treatment of glaucoma; a drop is placed in the eye every 3 or 4 hours. They have been employed for other ophthalmic conditions (corneal ulcers, alternately with atropine solutions to break down adhesions of the iris), but are of questionable value.

**Lamellæ Physostigminæ.**—Each contains  $\frac{1}{1000}$  grain of physostigmine sulphate and weighs  $\frac{1}{50}$  grain.



*Pharmacology.*—The discs are merely a convenient method of applying physostigmine to the eye in the treatment of glaucoma.

*Antagonism of Atropine and Physostigmine.*—These two alkaloids are mutually antagonistic to a much greater degree than are atropine and pilocarpine. If dilute solutions are alternately applied to the eye, contraction and dilatation of the pupil can be alternately produced. Or, if the solutions are injected into a salivary gland, secretion and cessation of secretion can be alternately obtained. The two alkaloids, however, are not mutually antagonistic on all organs and tissues. The explanations which have been suggested cannot be entered into here.

Iso-physostigmine has an action similar to, but in mammals somewhat more powerful than, physostigmine. Thus a 0.1 per cent. solution dropped into the eye causes contraction of the pupil more quickly and completely and the action lasts longer than after the application of a similar strength of physostigmine. It is also said to have a more powerful action on the intestine than physostigmine.

### IPECACUANHA

Ipecacuanha root contains three alkaloids, but only two, emetine and cephaeline, are important.

Emetine,  $(C_{15}H_{22}NO_2)_2$ , is methyl-cephaeline. It is a whitish amorphous powder, but forms crystalline salts. Cephaeline,  $(C_{14}H_{20}NO_2)_2$  occurs as white silky needles. Psychotrine, the third alkaloid, is also crystalline.

*Pharmacological Action of Emetine and Cephaeline.*—Both are irritant; rubbed on the skin in the form of an ointment they produce cutaneous eruptions. When taken by the mouth in small doses ( $\frac{1}{10}$  grain) they quickly cause nausea and vomiting. The symptoms produced are merely those associated with vomiting. Cephaeline is the more powerful emetic of the two, only about half the emetic dose of emetine being required to induce vomiting, and it also seems to be relatively less depressant. In non-emetic doses they act as expectorants and diaphoretics, and emetine,

appears to be a better expectorant than cephaeline. The other actions of these alkaloids are only of pharmacological interest.

**Ipecacuanhæ Radix.**—‘The dried root of *Psychotria Ipecacuanha*, *Stokes*.’

*Characters.*—Slender, somewhat tortuous pieces, about  $\frac{1}{4}$  inch in thickness, dark brown or dark brick-red in colour, marked by close irregular disc-like annulations. The fracture

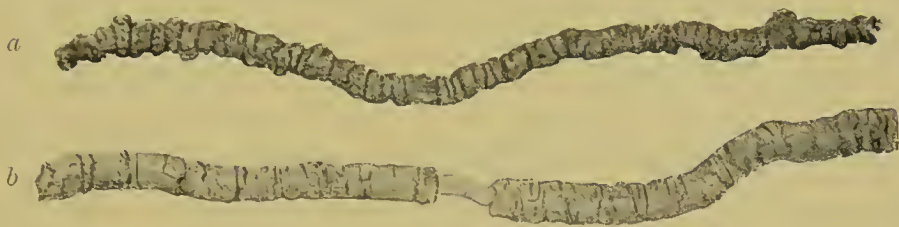


FIG. 26.

(a) Root of *Psychotria Ipecacuanha*; (b) root of *Psychotria acuminata* (*Carthagena ipecacuanha*), not official, but found in commerce; shows central wood, common to both varieties. Natural size.

is short, and the section shows a thick greyish bark and a small dense central wood. It has a slight unpleasant odour and a bitter taste.

*Carthagena ipecacuanha* is usually somewhat larger in size, the annulations are less numerous, and take the form of narrow raised ridges. It is not official, although it is not inferior therapeutically to the official variety.

*Chief Constituents.*—**Emetine** (about 1·5 per cent.); **Cephaeline** (about 0·5 per cent.); **Psychotrine** (about 0·04 per cent.). The relative proportions of the alkaloids vary somewhat.

Ipecacuanhic acid ( $C_{17}H_{26}O_{10}$ —a glucoside); resin; small quantities of a volatile oil also occur.

*Dose.*—As an expectorant,  $\frac{1}{4}$  to 2 grains; as an emetic, 15 to 30 grains.

*Pharmacology.*—Its action is due mainly to the alkaloids it contains.

Powdered ipecacuanha is irritant. If rubbed into the skin in the form of an ointment it causes irritation and may even

produce a pustular eruption ; if sniffed it causes severe sneezing and a watery secretion from the nose. Taken by the mouth it has a bitter, somewhat acrid taste, and, in doses of 20 grains, causes nausea and vomiting in about 30 minutes. Very large doses, unless rejected by vomiting, produce severe inflammation of the stomach and intestines.

When taken in small, non-emetic doses, it acts as an expectorant and mild diaphoretic, increasing the bronchial mucus and, slightly, the sweat. It has a depressant action on the heart.

It is used mainly as an expectorant in bronchitis, occasionally as an emetic in the acute bronchitis of children, but generally in the form of one of its preparations. The powdered root itself is rarely given except in dysentery. For this disease it is one of the best remedies. Large doses (30 to 60 grains are given and are frequently preceded by small doses of opium to prevent vomiting. Its mode of action is unknown.

**Extractum Ipecacuanhæ Liquidum.**—Contains 2 to  $2\frac{1}{4}$  per cent. of the alkaloids of ipecacuanha root.

*Dose.*—As an expectorant,  $\frac{1}{2}$  to 2 minims ; as an emetic, 15 to 20 minims.

*Pharmacology.*—It may be employed for any of the purposes for which ipecacuanha is useful, but it is used mainly for preparing the wine.

**Acetum Ipecacuanhæ.**—Contains 0·1 per cent. of the alkaloids of ipecacuanha root in dilute acetic acid containing a little alcohol.

Liquid extract of ipecacuanha, 1 fl. oz. ; alcohol (90 per cent.), 2 fl. oz. ; diluted acetic acid, 17 fl. oz.

*Dose.*—10 to 30 minims.

*Pharmacology.*—Its action and uses are practically the same as those of the wine. It is rarely prescribed.

**Vinum Ipecacuanhæ.**—A 0·1 per cent. solution of the alkaloids of ipecacuanha root in sherry.

Liquid extract of ipecacuanha, 1 fl. oz. ; sherry, 19 fl. oz.

*Dose.*—10 to 30 minims as an expectorant; 4 to 6 fluid drachms as an emetic.

*Pharmacology.*—It has a slight not unpleasant taste, and in small doses is well borne by the stomach. Repeated administration of moderate doses tends to produce nausea and large doses cause vomiting.

It is employed chiefly in the treatment of bronchitis in children; it is less valuable in adults. The best results are seen where there is tenacious, somewhat scanty, secretion, and are obtained only when the preparation is pushed. It is sometimes given to children in large doses to produce vomiting in cases of acute bronchitis where the small bronchial tubes are becoming clogged by secretion; the act of vomiting frequently opens up the air paths. Doses of a few minims, frequently repeated, have been given in the vomiting of pregnancy.

**Pulvis Ipecacuanhæ Compositus.**—Contains 1 of powdered ipecacuanha root and 1 of opium in 10. See page 317.

**Pilula Ipecacuanhæ cum Scilla.**—Contains ipecacuanha, opium, squill, and ammoniacum. See page 317.

**Trochiscus Ipecacuanhæ.**—Each lozenge contains  $\frac{1}{4}$  grain of powdered ipecacuanha root. Fruit basis.

*Pharmacology.*—A convenient and pleasant means of administering ipecacuanha in bronchial catarrh.

**Trochiscus Morphinæ et Ipecacuanhæ.**—Each lozenge contains  $\frac{1}{12}$  grain of powdered ipecacuanha root and  $\frac{1}{36}$  grain of morphine hydrochloride. Tolu basis. See page 320.

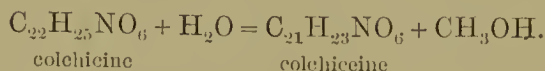
## COLCHICUM

The fresh and the dried sliced corm, and the dried, ripe seeds are official. They contain an alkaloid, colchicine.

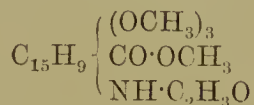
Colchicine ( $C_{22}H_{25}NO_6$ ) occurs as a clear yellow amorphous mass moderately soluble in water. It is easily decomposed by dilute hydro-



chloric acid into colchicine and methyl alcohol. The action is a simple hydrolysis.



Strong hydrochloric acid first decomposes it into trimethyl-colchicic acid, acetic acid, and methyl alcohol. The trimethyl-colchicic acid is then acted upon, and finally colchicic acid and methyl chloride are formed. Colchicine is therefore methyl-colchicine, and colchicine is an acetyl derivative of trimethyl-colchicic acid. The formula for colchicine has been given as—



This would exclude it from the group of alkaloids as previously defined; nevertheless it gives the ordinary alkaloidal reactions.

*Pharmacological Action of Colchicine.*—Colchicine is an irritant and little is known of its pharmacological action beyond its irritant effects. When given by the mouth or injected hypodermically it produces in a few hours symptoms of inflammation of the stomach and intestine (vomiting, diarrhoea, abdominal pain, &c.) accompanied by weakness of the hind limbs. This weakness increases to paralysis and extends anteriorly until the respiratory muscles are affected, and the animal dies from respiratory failure. These effects have been attributed to the formation of oxy-di-colchicine in the body; but this is improbable. It has but little action on the heart, and its effect on the urinary secretion is variable. It has been said to cause a diminution followed by an increase in the leucocytes of the blood. It has been very little used therapeutically.

**Colchici Cormus.**—‘The fresh corm of *Colchicum autumnale*, *Linn.*, collected in early summer; and the same stripped of its coats, sliced transversely, and dried at a temperature not exceeding 65.5°C.’

*Characters.*—The fresh corm is about 1½ inches long, and 1 inch broad, bluntly conical in shape, with a groove on one side where a new corm is forming, and covered with an outer brown, and an inner reddish-yellow membranous coat. On

section it shows a white fleshy interior and exudes a milky juice with a disagreeable odour and a bitter taste.

The dried transverse slices (fig. 27, *c*), are firm, about  $\frac{1}{2}$  inch thick, somewhat reniform in outline, and have a yellowish circumference and a greyish surface which is



FIG. 27.

The sliced dried corm of *Colchicum autumnale*. (*c*) Shows an horizontal section agreeing with the official description; (*a*) and (*b*) are vertical sections, which are not infrequently found; (*b*) shows the outer surface with longitudinal groove. Natural size.

marked with scattered darker points (fibro-vascular bundles). The fracture is short. They are odourless, but have a bitter taste. Longitudinal sections are not infrequently met with (see fig. 27*a*).

*Chief Constituents*.—**Colchicine** (0·5 to 0·6 per cent.); colchicine (?) ; resinous matter.

The disagreeable odour of the juice of the fresh corm is due to a volatile oil which disappears in the process of drying.

*Dose of the dried corm*.—2 to 5 grains.

*Pharmacology*.—This drug is solely used in the treatment of gout and hitherto no explanation of its action in this disease has been found. Single pharmacopœial doses usually produce no distinct effects in healthy men, but if repeatedly administered they are liable to cause gastro-intestinal irritation. Large doses cause, after some hours, gastro-enteritis (vomiting, diarrhœa, often bloody stools, severe abdominal pain, &c.), and symptoms of collapse.

The effect of therapeutic doses on the secretion of urine, and the excretion of uric acid, is variable. The heart is

unaffected by large doses given experimentally, but clinically colchicum is regarded as a cardiac depressant.

It is used largely in the treatment of acute gout; in chronic forms it is much less beneficial. It is commonly given as the wine, but any preparation may be employed; the tincture made from the seeds is probably the best.

From the **fresh** corm.

**Extractum Colchici.**—A ‘fresh’ extract.

*Dose.*— $\frac{1}{4}$  to 1 grain.

From the **dried** corm.

**Vinum Colchici.**—Contains the active principle of 1 ounce of corm in 5 fluid ounces of sherry.

*Dose.*—10 to 30 minims.

**Colchici Semina.**—‘The dried ripe seeds of *Colchicum autumnale*, *Linn.*’

*Characters.*—Hard seeds, about  $\frac{1}{10}$  inch in diameter, somewhat globular in shape, but pointed at the hilum, minutely pitted and of a dull reddish-brown colour. They have a bitter acrid taste but no odour.



FIG. 28.

Colchicum seeds.  $\frac{3}{1}$  linear.

Black mustard seeds are smaller, darker, and softer, and have a characteristic pungent taste.

*Chief Constituents.*—**Colchicine** (0·6 to 1 per cent.); **colchiceine** (?); resinous matter ( $\alpha$ -colchico-resin,  $\beta$ -colchico-resin). Fixed oil (6 to 8 per cent.).

*Pharmacology.*—The same as the corm.

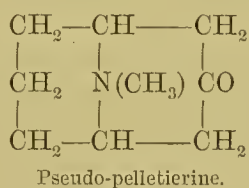
**Tinctura Colchici Seminum.**—Contains the active ingredients of 1 ounce of seeds in 5 fluid ounces.

*Dose.*—5 to 15 minims.

## POMEGRANATE BARK

The bark of the root and stem of the pomegranate contains several alkaloids—pelletierine, iso-pelletierine, methyl-pelletierine, iso-methyl-pelletierine, and pseudo-pelletierine—of which pelletierine is the chief.

Pseudo-pelletierine ( $C_9H_{15}NO$ ) is a crystalline substance, and its constitution has been determined with some degree of probability (compare the formula with that of tropine, page 273); the rest are oily fluids. Pelletierine ( $C_8H_{15}NO$ ) readily absorbs oxygen from the air and gradually darkens in colour. Iso-pelletierine ( $C_8H_{15}NO$ ). Methyl-pelletierine ( $C_9H_{17}NO$ ).



*Pharmacological Action of Pelletierine.*—It is a specific poison to tape-worms; a solution of 1 in 10,000 quickly kills them. It is not a powerful poison to man, but ill-effects from its use have frequently been described. These are headache, dizziness, dimness of vision, vomiting, diarrhœa, and prostration, and occasionally cramps.

It is used, mainly in France, in the treatment of tape-worm. Four to eight grains are given on an empty stomach, and are followed, a few hours afterwards, by a purgative. As pelletierine is easily absorbed it is generally combined with tannic acid.

Iso-pelletierine has a similar action to pelletierine; the remaining alkaloids are practically inactive.

**Granati Cortex.**—‘The dried bark of the stem and root of *Punica Granatum*, *Linn.*’

*Characters.*—Usually in pieces varying from 2 to 4 inches in length and from  $\frac{1}{2}$  to 1 inch in width. The root-bark generally occurs in irregular curved or flattish pieces, the outer surface being yellowish-grey in colour and marked with irregular conchoidal depressions; the inner surface is yellow, mottled with patches of brown. The stem-bark is straighter



and usually occurs in channelled or quilled pieces ; the outer surface is smoother than the root-bark, has no conchoidal depressions, but frequently bears minute lichens. The frac-

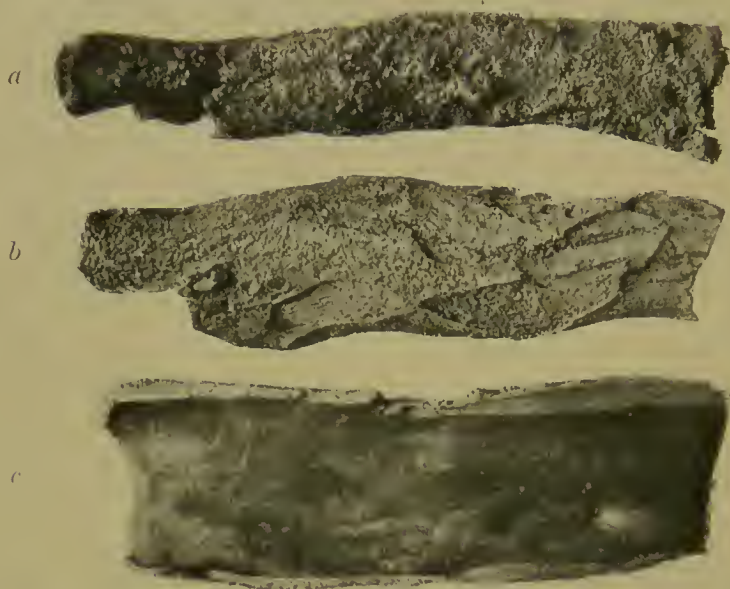


FIG. 29.

Bark of stem (a) and root (b) of *Punica Granatum* ; (c) inner surface of root bark, showing patchy colouring.  $\frac{3}{4}$  linear.

ture in both is short, and the fractured surface pale in colour. The taste is astringent and slightly bitter.

*Chief Constituents.* — **Pelletierine** ; **Iso-pelletierine** ; Methyl-pelletierine ; Iso-methyl-pelletierine ; Pseudo-pelletierine. Total alkaloids, average commercial sample, 0·35 per cent. (Good fresh root-bark is said to have yielded 3 per cent.). **Tannic acid** (20 to 25 per cent.)

The root-bark contains a larger percentage of alkaloids than the stem-bark, but it cannot always be obtained alone as a commercial product.

**Decoctum Granati Corticis.**—Contains the active principles of 1 ounce of pomegranate bark in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

*Pharmacology.*—It has an unpleasant astringent, somewhat bitter taste, and frequently causes nausea and sometimes vomiting. Occasionally it produces more severe

ill-effects—colic, diarrhœa, giddiness, weakness, and even collapse.

It is used in the treatment of tape-worms. The bowels are emptied by a purgative administered overnight and three or four full doses of the decoction are given at intervals of a half to one hour early the next morning. A purgative is afterwards administered. This treatment is generally efficacious, but is not much used in this country.

#### CUSPARIA BARK

**Cuspariæ Cortex.**—‘The dried bark of *Cusparia febrifuga*, DC.’

*Characters.*—Flattened or curved pieces, or single quills, generally about 3 or 4 inches long, 1 inch wide, and  $\frac{1}{12}$  inch

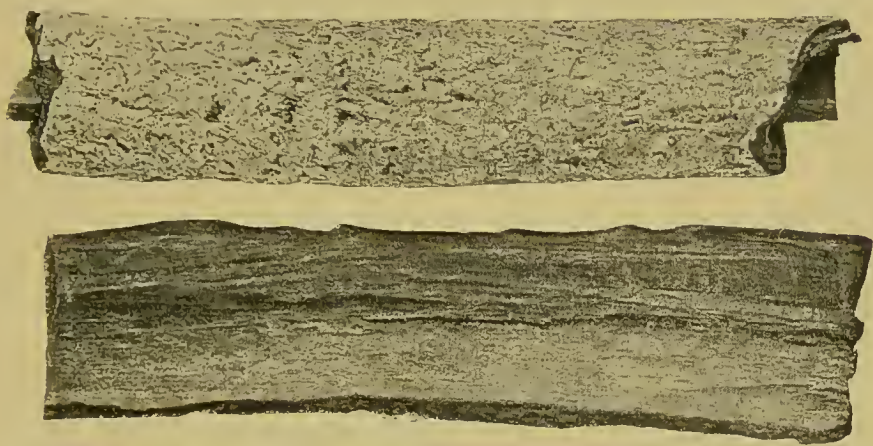


FIG. 30.

Cusparia bark, showing quill with spongy cork; and laminated inner surface. Natural size.

thick. The outer layer usually consists of a buff-coloured spongy cork which is easily removed, disclosing the hard dark-brown cortex. The inner surface is cinnamon-brown in colour, finely striated, and frequently laminated. The fracture is short and resinous. The transverse section when examined with a lens shows numerous white and dark points and wavy radial lines. The bark has a musty odour and a bitter taste.

*Chief Constituents.*—Cusparine, cusparidine, galipeine, galipedine, and probably other alkaloids; angosturin, a crystalline bitter principle; a glucoside; a volatile oil (1·5 per cent.); resin.

*Pharmacology.*—It has been used as a remedy for malaria, but is greatly inferior to quinine. Its action is mainly that of an aromatic bitter (see page 454). It is very little used.

**Infusum Cuspariæ.**—Contains the soluble principles of 1 ounce of cusparia bark in 20 fluid ounces.

*Dose.*—1 to 2 fluid ounces.

**Liquor Cuspariæ Concentratus.**—Contains the principles of 1 ounce of drug in 2 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

## BROOM

The common broom yields an alkaloid, sparteine, and a neutral principle, scoparin, both of which have been regarded as the active principle.

Sparteine,  $C_{15}H_{26}N_2$ , is a colourless oily liquid, slightly soluble in water and having a bitter taste and a smell resembling aniline. It is believed to be a pyridine derivative. Oxidising agents convert it into mono-, di-, and tri-oxysparteine.

*Pharmacological Action of Sparteine.*—It closely resembles coniine in most of its actions, but it is much less toxic than this alkaloid. Its action on the heart has been found by some observers to simulate that of digitalis, but this has been denied by others. It has been employed as a cardiac tonic, but has been abandoned.

**Scoparii Cacumina**—broom tops. ‘The fresh and the dried tops of *Cytisus scoparius*, *Link.*’

*Characters.*—The stem gives off, at an acute angle, numerous long, straight, slender, and winged branches, arranged alternately, which in the fresh tops are tough and flexible and bear small sessile leaves. The lower leaves of

the plant are trifoliate and stalked. During drying most of the leaves fall off. The colour of the fresh drug is dark green, of the dried drug, brownish green. The fresh tops, especially when bruised, have a characteristic odour; the dried tops are almost odourless. The taste is bitter and nauseous.



FIG. 31.

Fresh (a) and dried (b) Broom Tops.  $\frac{1}{4}$  linear.

*Chief Constituents.*—**Sparteine**; **scoparin** (a yellow crystalline neutral principle); a volatile oil in the fresh drug; a small amount of tannin.

Made from the **fresh** tops.



**Succus Scoparii.**—The juice of the bruised fresh tops to which one-third its volume of 90 per cent. alcohol has been added.

*Dose.*—1 to 2 fluid drachms.

*Pharmacology.*—It has an unpleasant somewhat nauseous taste. In pharmacopœial doses it slightly increases the quantity of urine secreted, and is used solely for this purpose. It is employed occasionally in the treatment of dropsy due to heart disease.

Made from the **dried tops**.

**Infusum Scoparii.**—Contains the active principles of 1 ounce of bruised drug in 10 fluid ounces.

*Dose.*—1 to 2 fluid ounces.

*Pharmacology.*—It is slightly diuretic and is commonly employed as an excipient in diuretic mixtures. It contains less volatile oil than the Succus.

#### PAREIRA ROOT

**Pareiræ Radix.**—‘The dried root of *Chondrodendron tomentosum*, *Ruiz and Pavon*.’

*Characters.*—Long, nearly cylindrical, more or less twisted and knotted pieces, nearly black in colour, and

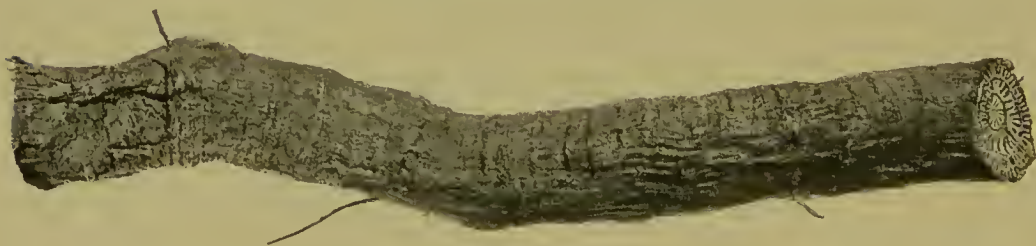


FIG. 32.

Pareira root, showing appearance of section.  $\frac{1}{2}$  linear.

marked with longitudinal furrows and transverse ridges and fissures. It is usually about 1 to  $1\frac{1}{2}$  inches in diameter, but may be more. The transverse section is characteristic; it shows a thin bark, and four or five crenated, concentric or somewhat eccentric zones, consisting of numerous wedge-

shaped pieces of porous wood separated by large medullary rays; the surface is waxy; the colour yellowish or brownish-grey. The root has no odour, but has a bitter taste.

*Chief Constituents.*—Pelosine (0·5 to 0·8 per cent.), an alkaloid probably identical with bebeerine. Starch, mucilage, tannin, &c.

**Extractum Pareiræ Liquidum.**—A liquid extract containing  $\frac{1}{4}$  its weight of extractive matter. See page 24.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—It has no characteristic action. It is used in chronic inflammation of the urinary tract (pyelitis, cystitis, gleet, &c.), but is of little value.

#### SERPENTARY ROOT

This drug is believed to contain an alkaloid, aristolochine, apparently on the analogy that the alkaloid occurs in other species of *Aristolochia*. No alkaloid has been obtained from the drug, but it is convenient to describe it here.

**Serpentariæ Rhizoma.**—‘The dried rhizome and roots of *Aristolochia Serpentaria*, *Linn.*, or of *Aristolochia reticulata*, *Nutt.*’

*Characters.*—The rhizome of *Aristolochia reticulata*, which is the drug most frequently met with in commerce, is usually horizontal, about 1 inch in length and  $\frac{1}{6}$  to  $\frac{1}{10}$  inch in thickness. It gives off from its upper surface, in close succession, slender aerial stems, often showing the scars of leaves, and from its under surface and sides numerous long more or less curved, roots. The stems and roots frequently hide the rhizome. On section the rhizome shows a whitish eccentric pith.

The rhizome of *Aristolochia Serpentaria* is smaller in all parts, and the roots are wiry and interlacing.

The colour of both varieties is dull yellowish-brown, the odour is camphoraceous, the taste bitter and somewhat acrid.

*Chief Constituents.*—Aristolochine? (an alkaloid); a volatile oil (1 to 2 per cent.); tannin.

*Pharmacology.*—Its action is mainly that of an aromatic bitter (see page 454). It has been accredited with other actions on insufficient grounds. It is rarely employed in this country.

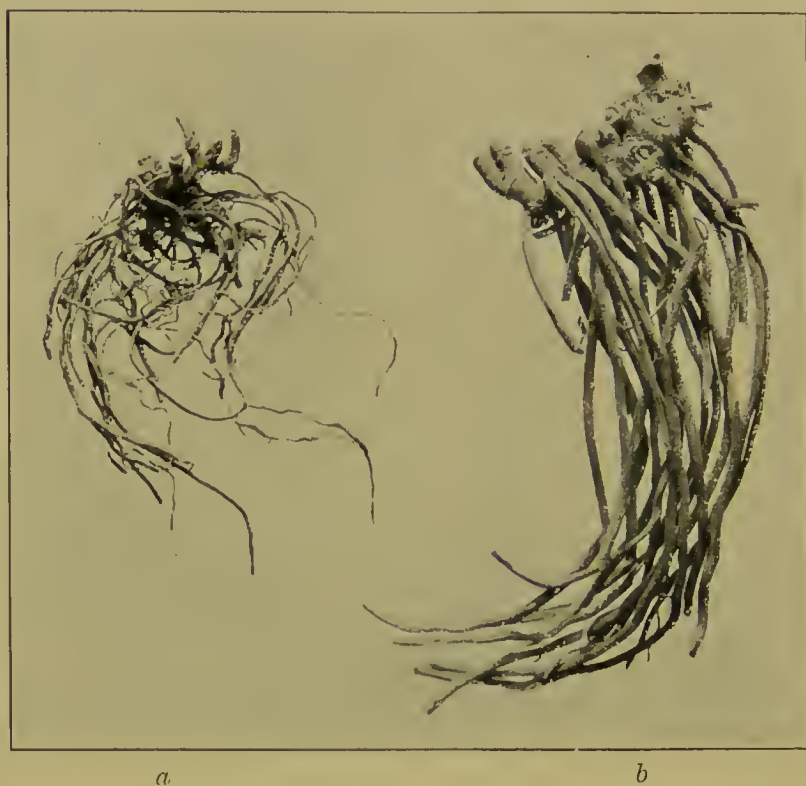


FIG. 33.

(a) Rhizome and roots of *Aristolochia Serpentaria*; (b) Rhizome and roots of *Aristolochia reticulata*. Natural size.

**Infusum Serpentariæ.**—Contains the active ingredients of 1 ounce of serpentary rhizome in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Liquor Serpentariæ Concentratus.**—Contains the active principles of 1 ounce of serpentary rhizome in 2 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

**Tinctura Serpentariæ.**—Contains the active principles of 1 ounce of serpentary rhizome in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Cinchonæ Composita.**—See page 294.

## DRUGS CONTAINING GLUCOSIDES AS ACTIVE PRINCIPLES

As already stated, only one glucoside—salicin—is official in the British Pharmacopœia, but many drugs owe their activity to this class of substances, or, in most cases, to the products into which they decompose.

They may be divided most conveniently into drugs yielding (i.) glucosides which act as cardiac tonics; (ii.) glucosides producing hydrocyanic acid; (iii.) glucosides yielding irritant oils; (iv.) saponin-glucosides; (v.) glucosides possessing a purgative action; (vi.) unclassified glucosides.

### GLUCOSIDES WHICH ACT AS CARDIAC TONICS

This group contains three official drugs—digitalis, strophanthus, and squill. Many other drugs contain glucosides which belong to this group, but none of them are official, and they are rarely employed in therapeutics.

#### DIGITALIS

The dried leaves are official, but the more or less active principles found in commerce are usually obtained from the seeds.

Most of the chemical work has been done on the principles obtained from the seeds, which do not appear to be identical with, although closely allied to, those of the leaves.

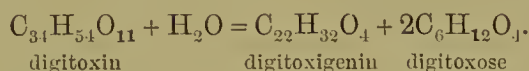
From the leaves have been obtained a crystalline glucoside  $\beta$ -digitoxin (so called to distinguish it from the digitoxin of the seeds), digitophyllin, digitalein, and an inactive saponin substance, amorphous digitonin. The seeds yield digitoxin,



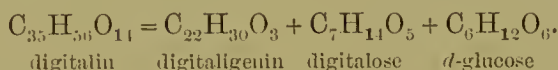
digitalin, digitalein, and a crystalline and an amorphous digitonin.

Commercial digitalins are frequently mixtures of substances. Some of them contain more than half their weight of inactive digitonin. A French digitalin (Nativelle's digitalin) is one of the most powerful, and is frequently used in therapeutics. It is probably digitophyllin.

Digitoxin may be decomposed into digitoxigenin and a sugar, digitoxose :



And digitoxigenin yields, on treatment with concentrated hydrochloric acid, anhydro-digitoxigenin, which appears to be identical with the digitaligenin obtained by decomposing digitalin.



Digitophyllin is probably methyl-digitoxin; digitonin (crystalline) may be decomposed into digitogenin, dextrose, and galactose.

The principles, digitoxin, digitalin, digitophyllin, and digitalein produce the characteristic digitalis action on the heart. The differences are mainly quantitative. The first three are very powerful, digitoxin being the most powerful; the last, digitalein, is comparatively weak. Digitalein, however, is soluble in water, the others are almost insoluble; digitalin is the most soluble, and digitophyllin the least soluble of the three. Digitophyllin is the most stable of the active principles.

The activity of digitalis leaves varies with the conditions under which they are grown, the time of the year when they are collected, and the care with which they are preserved.

**Digitalis Folia.**—‘The dried leaves of *Digitalis purpurea*, *Linn.* Collected from plants commencing to flower.’

*Characters.*—Broadly ovate to lanceolate in shape, with a distinctly crenate, or irregularly crenate-dentate margin, and a subacute or blunted apex. The margin of the leaf is prolonged down the petiole (winged petiole), and along it the lower veins are decurrent. The leaves vary in size, being

from 4 to 12 inches long and 2 to 6 inches broad. The upper surface is dull green in colour, and somewhat hairy; the under surface is paler and more densely pubescent, and is marked with a prominent midrib and prominent veins. The dried leaves have no distinctive odour, but have an unpleasant bitter taste.

The dried drug has often a crumpled and broken appearance, but can easily be distinguished by the prominent midrib and veins.

*Active Principles.* — **Digitoxin, digitophyllin, digitalein,** all crystalline glucosides. (Digitalin occurs in the seeds, see above.)

*Dose, in powder.*— $\frac{1}{2}$  to 2 grains.

*Pharmacology.* — Digitalis acts specially upon the heart and blood-vessels; it is also somewhat irritant.

If a dilute solution is perfused through an isolated frog's heart, the heart-beats become fewer, systole becomes more complete and prolonged, and the heart finally stops in systole. If injected into the circulation of a mammal, there is usually a preliminary slowing of the heart, due to stimulation of the cardio-inhibitory centre in the medulla, but soon the direct action on the cardiac muscle develops, and there is slowing of the heart with increase in the force and the length of systole. Diastole is variably affected, but this is of little practical importance. The blood-pressure rises—a result due, in the main, to contraction of the blood-vessels. This effect on the blood-vessels can be demonstrated by perfusing a solution of digitalis



FIG. 34.

Under surface of Digitalis leaf.  
Taken from a fresh specimen.  
 $\frac{3}{4}$  linear.

through the vessels of an excised organ. If large doses of digitalis are injected into the circulation, the heart subsequently becomes weak and irregular, and finally stops in diastole (not systole, as in frogs).

The best effects of digitalis in man are seen in cases of heart-failure. In such (say a case of mitral disease) the pulse is usually weak, rapid, and irregular, there is shortness of breath, dropsy, diminished secretion of urine, and various other symptoms. If small doses of digitalis—2 grains of the powder, or, better, 10 minims of the tincture—be given every 4 hours, the symptoms begin to improve in 36 to 48 hours, the pulse increases in force and becomes slower and more regular, the dyspnœa begins to disappear, the urine increases in amount, and the dropsy diminishes; and if the medicine is continued the pulse often becomes quite regular, and the dropsy and other symptoms due to a failing heart disappear. If the medicine is still continued, the pulse may become very slow and the urinary secretion may again diminish, and, if still further continued, symptoms of heart failure reappear.

The effect on the heart is a true tonic one; the cardiac muscle is toned up, it beats with greater force, it can withstand a greater resistance. Part of the beneficial action is also due to the tonic influence of the digitalis on the blood-vessels—a point, however, which cannot be further dwelt on here. The increase in the quantity of urine (the diuretic action of digitalis) and the disappearance of the symptoms are due to the improved state of the circulation.

It will be gathered from the above that digitalis tends to accumulate in the body. Its effects must, therefore, be watched with care. Fall of the pulse-rate much below the normal and a small urinary secretion are indications to cease its administration, and especially if these are accompanied, as they frequently are, by nausea and sickness and diarrhœa.

The use of digitalis may be summed up in the term ‘heart-failure.’ Whatever this condition is due to (except digitalis itself, or some other allied drug), digitalis may generally be given with benefit. It is commonly said to be contra-indicated in aortic regurgitation, because the diminished frequency of



the heart allows a longer period for blood to regurgitate back into the ventricle, but this appears to be due to a misconception of the action of digitalis. The sudden death which has frequently occurred in these cases on rising from bed is not due to the digitalis, or is due to its misuse.

In diseases other than so-called heart-disease, *e.g.* chronic bronchitis, emphysema, chronic Bright's disease, which cause a continued excessive strain on the heart, digitalis is often beneficial, because the aggravating condition is frequently more or less heart-failure. If this is not present, digitalis is useless.

**Infusum Digitalis.**—Contains the active principles of 60 grains of digitalis leaves in 20 fluid ounces.

*Dose.*—2 to 4 fluid drachms.

*Pharmacology.*—It is preferred by some physicians to the tincture, and is said to be a more powerful diuretic, but this is improbable.

**Tinctura Digitalis.**—Contains the active principles of 1 ounce of digitalis leaves in 8 fluid ounces.

*Dose.*—5 to 15 minims.

## STROPHANTHUS

Strophanthus seeds contain a crystalline glucoside, strophanthin.

Two different crystalline strophanthins have been obtained by different investigators from the seeds of *Strophanthus Kombé*, and a third amorphous strophanthin has been prepared from the seeds of *Strophanthus hispidus*. The relation of the two crystalline strophanthins, and whether they occur in the same or in different varieties of the plant, have not been determined. They both yield on hydrolysis strophanthidin and one or more sugars, and both are moderately soluble in water. To one the name of pseudo-strophanthin has been given.

*Pharmacological Action of Strophanthin.*—It acts on the heart in a similar manner to the active principles of digitalis, but it is much more powerful than these. It acts more rapidly, and it has less tendency to accumulate in the tissues, differences which are probably due to its much



greater solubility in aqueous media. It is also much less active as a vaso-constrictor, and is less powerful as a diuretic in heart disease.

Pseudo-strophanthin is more powerful than strophanthin.

**Strophanthi Semina.**—‘The dried ripe seeds of *Strophanthus Kombé*, *Oliver*, freed from the awns.’

*Characters.*—Oval-acuminate seeds of a greenish-fawn colour, flattened on one surface, the other surface showing a

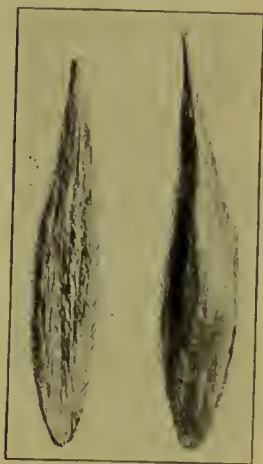


FIG. 35.

*Strophanthus* seeds, showing both surfaces. The hairs have been purposely made prominent at the periphery.  $\frac{2}{1}$  linear.

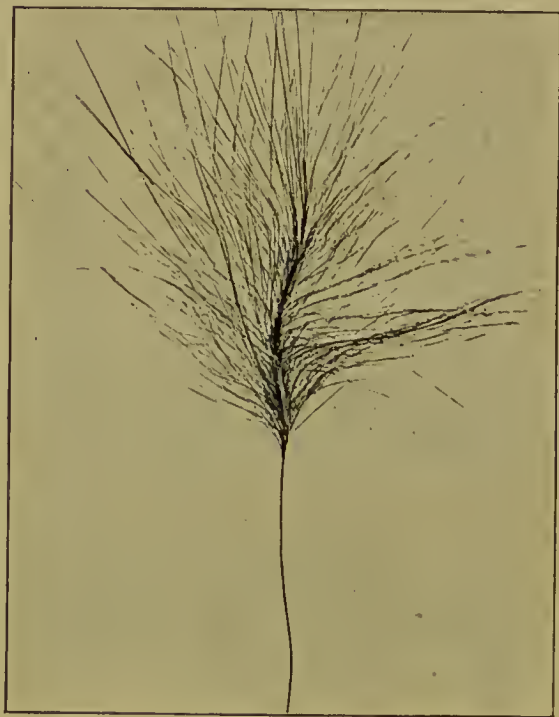


FIG. 36.

The upper part of the awn of a *Strophanthus* seed. Natural size.

longitudinal ridge which commences about the centre and becomes more prominent as it approaches the apex, where it terminates in the broken awn. The base is rounded. The seeds are about  $\frac{2}{5}$  inch long and  $\frac{1}{6}$  inch broad, and covered with stiff silvery hairs, which are most obvious on the flattened surface. On section it is seen to consist of two oily cotyledons, which are surrounded by a thin endosperm. On applying sulphuric acid to the section a green colour (often

reddish about the embryo) is produced, which is best marked near the periphery. The odour of the crushed seeds is faint but characteristic ; the taste is very bitter.

In the natural state the seeds possess an awn, about 4 to 5 inches long, which is usually broken off before the seeds are exported. The upper part of an awn is shown in fig. 36.

*Active Principle*.—**Strophanthin** (up to 3 per cent.).

The seeds contain a considerable amount of fixed oil.

*Pharmacology*.—That of the strophanthin they contain. This is a variable quantity, and consequently the effects obtained from preparations of the seeds have been by no means uniform. A good preparation is certainly valuable in the treatment of heart-failure, but it does not possess any decided advantages over digitalis, except perhaps in old people suffering from ‘senile heart,’ in which cases the vaso-constricting influence of digitalis is undesirable. Either of the two official preparations may be given.

**Extractum Strophanthi**.—An alcoholic extract containing the active principle of 1 ounce of seeds in 2 ounces of extract.

The fixed oil in the seeds is first removed with ether ; an alcoholic extract is made, and is evaporated until it begins to thicken ; sufficient milk sugar is then added to make the weight double that of the seeds taken.

*Dose*.— $\frac{1}{4}$  to 1 grain.

**Tinctura Strophanthi**.—Contains the active principle of  $\frac{1}{2}$  ounce of seeds in 20 fluid ounces.

*Dose*.—5 to 15 minims.

Preparations of strophanthus are liable to decompose gradually in aqueous solution.

## SQUILL

The chemistry of squill is in an unsatisfactory state. The active principles are variously given as scillain, or as scillitoxin and scillipicrin. All are described as amorphous

glucosides, and it is probable that scillain and scillitoxin are identical. A crystalline glucoside, scillin, has been obtained, but is pharmacologically inactive.

Scillain acts on the heart in a similar manner to the principles of *digitalis*.

**Scilla.**—‘The bulb of *Urginea Scilla*, *Steinh.*; divested of its dry membranous outer scales, cut into slices, and dried.’

The bulb of the squill is something like a large onion, hence its appearance when cut. There are a red and a white variety, the white alone being official in the British Pharmacopœia.

*Characters.*—Usually in the form of somewhat translucent, slightly yellowish or pinkish, curved strips, tapering towards each end, and from 1 to 2 inches in length; but occasionally



FIG. 37

Squill; (b) is the form most commonly seen, but pieces similar to (a) are not infrequently met with. Natural size.

as flattish strips or pieces of other shapes. When quite dry it is brittle and easily powdered; if moist, it is tough and flexible. It has no distinctive odour, but has a bitter, somewhat acid, taste.

*Chief Constituents.*—**Scillain**, an amorphous glucoside (see above). A saponin substance.

*Pharmacology.*—Its action resembles somewhat that of *digitalis*. It irritates more, and is therefore more liable to cause nausea and vomiting, and its effect on the circulation is less powerful; but it is a better diuretic, and is also a so-called stimulant expectorant.

It is used mainly in the treatment of chronic bronchitis with profuse expectoration. It is also employed, with other remedies, in dropsy, including cardiac dropsy, but it is not used as a substitute for digitalis or strophanthus in the treatment of heart-failure.

**Acetum Scillæ.**—Contains the active ingredients of 1 ounce of squill in 8 fluid ounces of diluted acetic acid.

*Dose.*—10 to 30 minims.

*Pharmacology.*—It may be employed in chronic bronchitis, but is not largely used.

**Syrupus Scillæ.**—The acetum saturated with sugar.

Vinegar of squill, 20 fl. oz. ; sugar, 38 oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Used in chronic bronchitis. It is a useful preparation to give to children.

**Oxymel Scillæ.**—Contains, roughly, the active principles of 1 of squill in 20 by weight or 15 by volume of a mixture of dilute acetic acid and honey.

Squill,  $2\frac{1}{2}$  oz. ; acetic acid,  $2\frac{1}{2}$  fl. oz. ; distilled water, 8 fl. oz. clarified honey, about 27 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Used in the treatment of chronic bronchial catarrh in children.

**Pilula Scillæ Composita.**—Contains squill  $\frac{1}{4}$  ; ammoniacum  $\frac{1}{5}$  ; ginger  $\frac{1}{5}$ .

Squill,  $1\frac{1}{4}$  ; ginger, 1 ; ammoniacum, 1 ; hard soap, 1 ; syrup of glucose, 1.

*Dose.*—4 to 8 grains.

*Pharmacology.*—A convenient preparation for administering squill in chronic bronchitis and other conditions. The ammoniacum aids the action of the squill on the bronchial mucous membrane and the kidneys ; the ginger acts as a carminative and diminishes any untoward effect on the alimentary canal. It is not much used.



**Pilula Ipecacuanhæ cum Scilla.**—Contains squill  $\frac{1}{6}$ ; ammoniacum  $\frac{1}{6}$ ; ipecacuanha root  $\frac{1}{20}$ ; opium  $\frac{1}{20}$ . See page 317.

**Tinctura Scillæ.**—Contains the active principles of 1 ounce of squill in 5 fluid ounces.

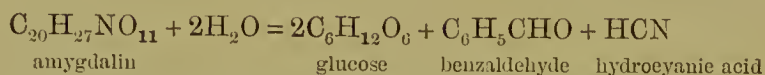
*Dose.*—5 to 15 minims.

*Pharmacology.*—It is the most commonly used preparation of squill. It is the only fluid preparation which is not acid, and is therefore the only one compatible with alkalies, such as ammonium carbonate.

## GLUCOSIDES PRODUCING HYDROCYANIC ACID

Three of the drugs of the Pharmacopœia—bitter almonds, cherry-laurel leaves, and Virginian prune bark—contain a glucoside, amygdalin (or one very closely allied to it), and a ferment, emulsin, and these, when the drug is treated with water, are brought into solution and interact, forming hydrocyanic acid and other substances (see page 8). The action of these drugs is mainly that of the hydrocyanic acid they yield. They are not much used medicinally.

The ferment acts the part of a hydrolysing agent. The reaction may be expressed as follows:



Amygdalin occurs in a crystalline and an amorphous variety. Amorphous amygdalin (laurocerasin) is probably a compound of amygdalin with amygdalic acid.

## ALMONDS

Both sweet and bitter almonds are official. Sweet almonds do not yield hydrocyanic acid when treated with water, because they contain no amygdalin, but they are otherwise so closely allied to bitter almonds that they may conveniently be described here.

**Amygdala Dulcis.**—‘The ripe seed of *Prunus Amygdalus*, *Stokes*, *var. dulcis*, *Baillon*. It is known in commerce as the Jordan almond.’

*Characters.*—Nearly oblong flattened seeds of a cinnamon-brown colour, rounded at one end, pointed at the other. On section they are seen to be composed of a thin rough testa, which encloses two large oily cotyledons. The cotyledons deprived of the testa (blanched almonds) when rubbed with



FIG. 38.

(a) Sweet Almond. (b) Bitter Almond. The sections show the cotyledons with plumule and radicle. Natural size.

water form an emulsion with no distinctive odour. The taste is nutty and characteristic.

*Chief Constituents.*—Proteid (about 20 per cent.) ; fixed oil (about 50 per cent.) The seeds contain no starch. They contain emulsin but no amygdalin.

*Pharmacology.*—They are innocuous, and merely act the part of foods. (Almond flour is used to make bread for diabetic patients.)

**Pulvis Amygdalæ Compositus.**—Consists of sweet almonds 8 ; sugar 4 ; gum acacia, 1.

It is used as an emulsifying agent, and to prepare the following mixture.

**Mistura Amygdalæ.**—Consists of 1 ounce of the compound powder rubbed up into an emulsion with 8 fluid ounces of distilled water, and strained.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—Used as a placebo, and a vehicle for cough medicines.

**Amygdala Amara.**—‘The ripe seed of *Prunus Amygdalus*, *Stokes*, var. *amara*, *Baillon*.’

*Characters.*—Similar to sweet almonds, but shorter and more ovate in shape. When rubbed with water they give off the odour of hydrocyanic acid. They have a bitter hydrocyanic-acid-like taste.

*Chief Constituents.*—Amygdalin (a crystalline glucoside) and emulsin (a ferment) which yield **hydrocyanic acid** (about 0·25 per cent. of weight of seeds); fixed oil (40 per cent.); proteids.

*Pharmacology.*—That of the hydrocyanic acid they yield. The seeds are not much used medicinally, hydrocyanic acid, cherry-laurel water or syrup of Virginian prune bark being preferred. They are chiefly employed as a source of the fixed oil (see page 545).

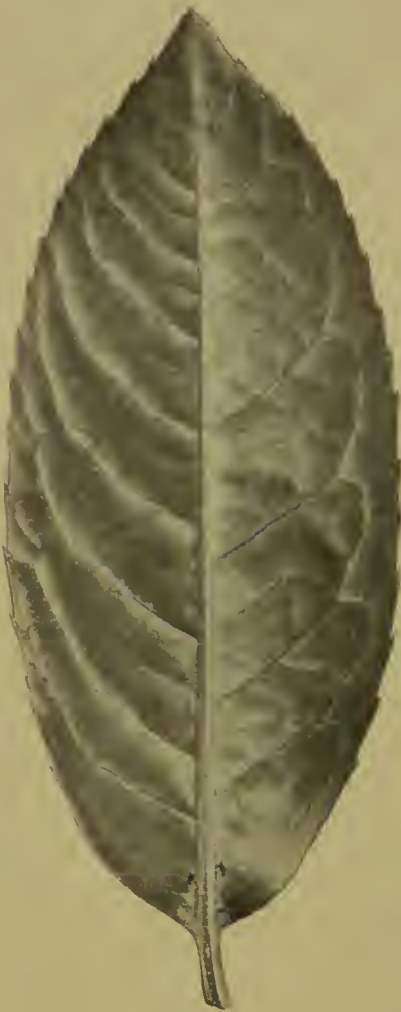


FIG. 39.

Fresh cherry-laurel leaf. Under surface. Natural size.

#### CHERRY-LAUREL LEAVES

**Laurocerasi Folia.** — ‘The fresh leaves of *Prunus Laurocerasus*, *Linn.*’

*Characters.* — Thick, coriaceous, oblong-lanceolate leaves, with a distantly serrated and slightly recurved margin, and a shortly acute and somewhat recurved apex; about 5 to 6 inches in length, and about 2 inches broad. The petiole is short and stout. The upper surface is dark-green in colour and glossy; the under surface is paler and

shows a prominent midrib, near the base of which, on each side, are one to four brownish depressed spots, the remains of glands. Almost inodorous when entire, but when bruised emitting the odour of hydrocyanic acid.

The dried leaves, which are not official, are liable to be confounded with jaborandi leaves, but the entire margin, the emarginate apex, and the oil glands of the latter readily serve to distinguish it from cherry-laurel leaves.

*Chief Constituents.*—Amorphous amygdalin (laurocerasin) and emulsin, which yield **hydrocyanic acid** (about 0·1 per cent. ; the yield varies somewhat with the time of the year).

**Aqua Laurocerasi.**—Standardised to contain 0·1 per cent. of hydrocyanic acid.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—That of a 0·1 per cent. solution of hydrocyanic acid. It may be employed in place of hydrocyanic acid in cases in which this is beneficial (to allay cutaneous, gastric, and bronchial irritation), but it is not much used. It is liable to deteriorate on keeping unless stored in well-stoppered bottles.

#### VIRGINIAN PRUNE BARK

**Pruni Virginianæ Cortex.**—‘The bark of *Prunus serotina*, Ehrh., collected in the autumn.’

*Characters.*—Curved or flattish pieces or fragments varying in size up to 5 inches in length, 2 inches in breadth, and about  $\frac{1}{8}$  inch in thickness. Young bark is sometimes covered with a reddish-brown, thin, smooth, sometimes glossy, papery cork, marked with whitish lenticels, but generally the cork has been removed, and the outer surface consists of the greenish-brown cortex marked with transversely elongated scars. In old bark the cortex is further denuded, and consequently it has a rough appearance, and is of a uniform cinnamon-brown colour. The inner surface is finely striated or fissured and reticulated, and is cinnamon-brown in colour. The fracture is short and granular, and the fractured



surface has a reddish-grey colour. The odour is slight until moistened, when it develops the smell of hydrocyanic acid; the taste is astringent, aromatic, and bitter.

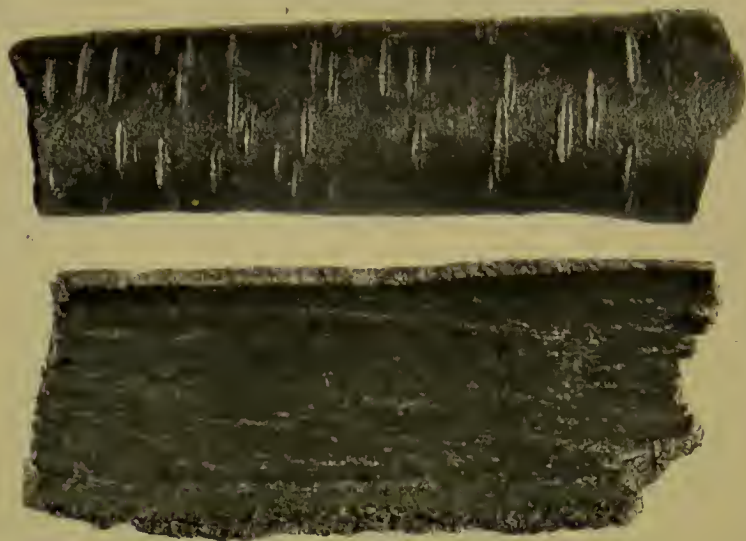


FIG. 40.

Virginian prune bark, showing external and internal surfaces. Natural size.

*Chief Constituents.*—Amorphous amygdalin, or a glucoside closely allied to it, and a ferment, which give **hydrocyanic acid** (0.15 to 0.2 per cent. of bark); a bitter crystalline glucoside; tannin (about 3.5 per cent.).

*Pharmacology.*—Its action is due almost solely to the hydrocyanic acid which is formed. It has also a mild bitter action (see page 453).

**Syrupus Pruni Virginianæ.**—A syrup containing 0.02 to 0.03 per cent. of hydrocyanic acid.

Virginian prune bark, 3 oz.; refined sugar, 15 oz.; glycerin, 1½ fl. oz.; distilled water to make 20 fl. oz.

*Dose.*—½ to 1 fluid drachm.

*Pharmacology.*—It is sedative, and is used to alleviate the cough of phthisis and bronchitis, but it is not a powerful remedy. It is a useful flavouring syrup, especially for cough medicines.

**Tinctura Pruni Virginianæ.**—Contains 0·03 to 0·04 per cent. of hydrocyanic acid.

Virginian prune bark, 4 oz.; alcohol (90 per cent.), 12½ fl. oz.; distilled water, 7½ fl. oz.

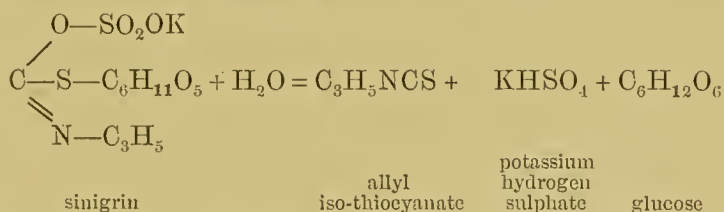
*Dose.*—½ to 1 fluid drachm.

*Pharmacology.*—It is sedative on account of the hydrocyanic acid it contains, and is also a mild bitter. It is useful in the same cases as the syrup, but is of greater service in chronic gastric catarrh.

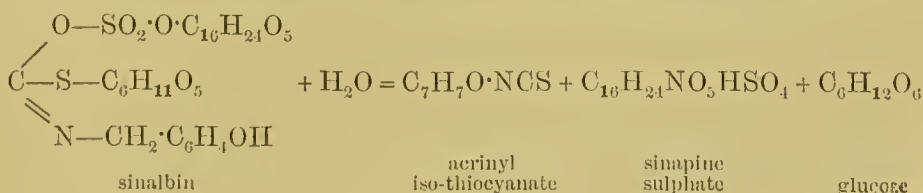
## GLUCOSIDES PRODUCING IRRITANT OILS

Black and white mustard seeds and horse-radish root (and other unofficial drugs) contain glucosides and ferments, which, when brought into solution, interact, and form, besides other substances, irritant oils. Black mustard seeds and horse-radish root contain the glucoside sinigrin (potassium myronate) and the ferment myrosin, which yield the official volatile oil of mustard (allyl iso-thiocyanate). White mustard seeds contain the same ferment, myrosin, but a different glucoside, sinalbin, and these form white mustard oil (acrinyl iso-thiocyanate). The ferments simply hydrolyse the glucosides.

Sinigrin is obtained as colourless crystals, soluble in water, forming a neutral solution with a bitter taste. Its hydrolysis by means of the ferment, myrosin, may be expressed as follows :



Sinalbin occurs in yellowish needles, moderately soluble in water, and having a bitter taste. Its hydrolysis may be expressed thus :



White mustard oil (acrinyl or para-hydroxy-benzyl iso-thiocyanate) is only slightly volatile. It has a faint anise odour at ordinary temperatures, but becomes very pungent if heated. It has a similar pharmacological action to volatile oil of mustard, but is less powerful and its effects appear more slowly.

Sinapin, the alkaloid produced by the hydrolysis of sinalbin, is an ester of choline and sinapic acid.

#### VOLATILE OIL OF MUSTARD

**Oleum Sinapis Volatile.**—‘Distilled from black mustard seeds after maceration with water.’

*Characters.*—A colourless or pale-yellow mobile liquid, with an irritating odour and a very pungent acrid taste. Soluble in 50 parts of water; miscible with alcohol and ether.

Specific gravity, 1.018 to 1.030. It distils between 147° and 152°C. It should contain no ethylic alcohol or petroleum.

It usually contains small amounts of other substances (allyl thiocyanate, cyanallyl), but these rarely exceed 1 or 2 per cent.

*Pharmacology.*—If a thin layer is painted on the skin it produces almost at once burning pain and redness, which usually disappear in 10 to 20 minutes. Larger amounts produce vesication and, if the application is continued, troublesome ulcers. It is not employed therapeutically in the pure form.

**Linimentum Sinapis.**—An alcoholic solution containing nearly 4 per cent. of volatile oil of mustard and 6 per cent. of camphor.

Volatile oil of mustard, 2 c.c.; camphor, 3 gr.; castor oil, 7 c.c.; alcohol (90 per cent.), 43 c.c.

*Pharmacology.*—A powerfully stimulating liniment. It may be employed to stimulate the growth of hair in patchy baldness of the scalp, or as a counter-irritant to relieve deep-seated pain.

#### MUSTARD SEEDS

**Sinapis Nigræ Semina.** ‘The dried ripe seeds of *Brassica nigra*, *Koch*.’

*Characters*.—Small dark reddish-brown and minutely pitted seeds, globular or somewhat ovoid in shape, about  $\frac{1}{25}$  inch in diameter, and  $\frac{1}{50}$  grain in weight. On section they show a greenish-yellow oily interior, which consists of two folded cotyledons embracing a small radicle. They are



FIG. 41.

(a) Black mustard seeds. (b) White mustard seeds.  $\frac{3}{4}$  linear.

odourless either entire or powdered, when dry, but when rubbed with water they develop a characteristic pungent odour. The taste is bitter at first, but quickly becomes strongly pungent.

Compare with colchicum seeds (page 346).

*Chief Constituents*.—Sinigrin, a crystalline glucoside, and myrosin, a ferment, which in presence of water react, forming **volatile oil of mustard** (0.5 to 0.75 per cent. of the seeds); fixed oil (31 to 33 per cent.).

**Sinapis** (see page 372).

**Charta Sinapis** (see page 373).

**Sinapis Albæ Semina**.—‘The dried ripe seeds of *Brassica alba*, Boiss.’

*Characters*.—Small, yellowish, almost globular seeds, minutely pitted, about  $\frac{1}{12}$  inch in diameter, and  $\frac{1}{10}$  grain in weight. Other characters similar to those of black mustard seeds, but the odour after triturating with water and the taste are less pungent.



*Chief Constituents.* Sinalbin, a crystalline glucoside, and myrosin, a ferment, which form, in the presence of water, **oil of white mustard** (acrinyl iso-thiocyanate); fixed oil (23 to 26 per cent.).

Oil of white mustard is less pungent and irritant than volatile oil of mustard, and hence white mustard seeds have a less pungent taste than black mustard seeds.

**Sinapis**—mustard. ‘The dried ripe seeds of *Brassica nigra* and *Brassica alba*, powdered and mixed.’

*Characters.* — A greenish-yellow powder, inodorous when dry, but exhaling a pungent odour when moistened with water. The taste is transiently bitter, then strongly pungent.

It should contain no turmeric or starch.

It is said that a mixture of powdered black and white mustard seeds is more economical than black mustard seeds alone, because the latter contain insufficient ferment to decompose the whole of the sinigrin present.

*Pharmacology.*—The action is due mainly to the volatile oil of mustard which is formed when the mustard comes in contact with water. Two to four teaspoonfuls added to a gallon of warm water form the so-called mustard bath. It produces a mild rubefacient effect, and is used as a foot bath in the treatment of colds and congestive headache, as a sitz bath for amenorrhœa, and as a general bath for children in the treatment of bronchitis, collapse, unconsciousness, &c. Mustard is applied as a local irritant in the form of mustard poultices and mustard leaves. The poultice is made by mixing it with an equal or double weight of linseed meal previously made into a poultice. It has a well-marked rubefacient action, and is used to apply to the back in pneumonia, pleurisy, and bronchitis, and to the loin to relieve congestion of the kidneys. It may be left on about four hours.

Taken by the mouth, mustard has a characteristic pungent taste, and is used almost solely as a condiment. A teaspoonful mixed with warm water will produce

vomiting, and may be used as an emetic in case of emergency.

**Charta Sinapis.**—Black and white mustard seeds deprived of their fixed oil, powdered, mixed with solution of india-rubber and spread upon cartridge paper.

**Pharmacology.**—It is dipped into warm water, and applied to the skin. After a short interval, prickling is experienced, which gradually increases to a burning sensation, and generally necessitates the removal of the mustard paper in about thirty minutes. Well-marked redness will then be noticed. The preparation is used mainly as a counter-irritant to relieve deep-seated abdominal and other pains.

#### HORSE-RADISH ROOT

**Armoraciæ Radix.**—‘The fresh root of *Cochlearia Armoracia*, *Linn.*, collected from cultivated plants.’

**Characters.**—Pale-brown or cream-coloured, nearly cylindrical roots, usually a foot or more in length, and about 1 inch in diameter, enlarged and often divided at the crown, which is marked by closely approximated semi-amplexicaul leaf-scars. It gives off but few lateral rootlets. The section is whitish. It is indorous when entire, but exhales a characteristic mustard-like odour when scraped or bruised. The taste is pungent.

**Active Principles.**—The glucoside sinigrin, and the ferment myrosin, which produce **volatile oil of mustard** (about 0.05 per cent. of the weight of the root).

It is most active in the early spring and autumn.

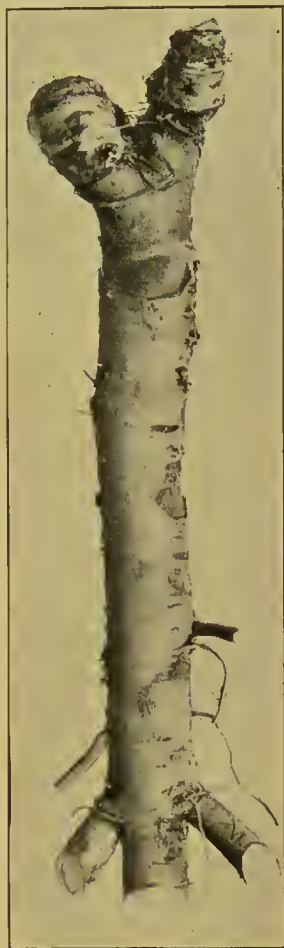


FIG. 42.

Fresh horse-radish root.  
 $\frac{1}{4}$  linear.

*Pharmacology*.—Its action is similar to mustard, but weaker. Except as a condiment, it is used only in the form of the following preparation.

**Spiritus Armoraciæ Compositus.** — Contains the active volatile ingredients of 5 ounces of horse-radish root, 5 ounces of bitter orange-peel, and a little nutmeg, in 40 fluid ounces.

Horse-radish root, 5 oz. ; dried bitter-orange peel, 5 oz. ; nutmeg, bruised, 55 gr. ; alcohol (90 per cent.),  $1\frac{1}{4}$  pints ; distilled water  $1\frac{1}{2}$  pints. Mix and distil 2 pints.

*Dose*.—1 to 2 fluid drachms.

*Pharmacology*.—It has a pleasant pungent taste, and acts in a similar manner to a volatile oil (see page 469). It is used mainly as a gastric tonic and carminative in chronic gastric catarrh.

## SAPONIN-GLUCOSIDES

The four following drugs yield saponins. They are of comparatively little therapeutical importance.

Saponins are a variety of glucosides which are soluble in water, forming solutions which froth strongly when shaken. They are decomposed by dilute acids into sapogenins and sugars (and, usually, a small quantity of a volatile substance with an aromatic odour). They are soluble in solutions of caustic alkalies and carbonates, often in alcohol, slightly in chloroform, but not at all in ether. Most of them give characteristic colours with strong sulphuric acid, and some of them are slightly acid in character. They are irritating to mucous membranes, producing violent sneezing if sniffed, possess a very acrid taste, and are powerful solvents of red blood-corpuscles. They also have the power of suspending insoluble substances in aqueous solution. The general formula  $C_nH_{2n-8}O_{10}$  has been given to them.

The different saponins are distinguished by prefixing the name of the drug from which they are derived, except in the case of quillaia bark, which is commonly called saponin, instead of quillaia-saponin.

The more powerful pharmacologically-active saponins are known as **sapotoxins**.

*Pharmacological Action of Saponins*.—The most characteristic actions of the saponins are their irritant action when

applied to mucous membranes or denuded surfaces, and their powerful influence in dissolving red blood-corpuscles when brought into contact with them. They have practically no action on the unbroken skin unless applied as an ointment and well rubbed in, when they produce irritation.

When sniffed in fine powder they produce violent sneezing. If taken in solution they have an acrid taste, and produce an acrid sensation in the throat. In small doses they have no other obvious effect, but large doses produce severe gastrointestinal irritation. Most of them are not absorbed as such or are absorbed very slowly, and consequently they do not produce a distinct general action when administered in this way. If, however, they are injected intravenously, they produce severe effects, and are markedly toxic.

Their action on red blood-corpuscles is of more scientific than practical interest. Very dilute solutions will destroy these, whether normal or hardened. Consequently, blood to which they are added becomes laked. This action explains some of the symptoms observed when saponins are injected intravenously.

#### QUILLAIA BARK

**Quillaiaæ Cortex**—soap bark. ‘The inner part of the bark of *Quillaja saponaria*, *Molina*.’

*Characters*.—Occurs in pieces of very varying size. It is imported in large, flattish pieces about 3 feet in length, 4 to 6 inches broad, and about  $\frac{1}{4}$  inch thick. The external surface is rough, longitudinally striated, and of a cream or pale-brown colour, except in places where the outer bark has been imperfectly removed, in which places it is reddish or blackish-brown in colour. The inner surface is smooth and cream-coloured. The fracture is splintery, and the fractured surface appears somewhat laminated and exhibits minute glistening points (calcium oxalate crystals; also often to be seen on the outer surface). It has no distinctive odour, but the powder, if sniffed, produces violent sneezing; the taste is acrid.

*Chief Constituents*.—Sapotoxin, quillajic acid, methyl-



quillajic acid?, saponin (an inactive modification of quillajic acid?). Total saponins about 9 per cent.

Commercial saponin consists of a mixture of these.



FIG. 43.

Quillaia bark, showing external and internal surfaces.  $\frac{2}{3}$  linear.

**Tinctura Quillaiaæ.**—Contains the saponins of 1 ounce of quillaia bark in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—That of the saponins it contains. It has been used as an expectorant, but is of doubtful value. It is employed as an emulsifying agent, but is unsuitable for medicines intended for internal use.

**Liquor Picis Carbonis.**—See page 538.

SENEGA ROOT

**Senegæ Radix.**—‘The dried root of *Polygala senega*, *Linn.*’

*Characters.*—Slender, more or less curved or contorted roots, from 2 to 4 inches in length, greyish or brownish-yellow in colour, and surmounted by a crown which bears the bases of numerous slender aerial stems. The root gradually tapers, and often divides into a few branches. The cortex has a somewhat translucent appearance, is longitudinally and sometimes transversely wrinkled, and in the upper part is frequently thickened longitudinally along one side, forming a so-called keel. It breaks with a short fracture, and the section shows a large whitish wood, which in the upper part of the root is usually irregularly developed, appearing as though wedge-shaped pieces had been removed. The odour is slight but characteristic; the taste is at first sweet, then acrid.

*Chief Constituents.*—Two saponins—**senegin** and **polygalic acid**; small amounts of methyl salicylate (probably exists as gaultherin), an ester of valerianic acid, resin, &c.

*Pharmacology.*—It has a local irritant action due to the saponins it contains, and it is believed to increase and aid the expulsion of the bronchial secretion, but satisfactory evidence on this point is wanting. It is used almost solely, in combination with other remedies, in the



FIG. 44.

Senega root, and sections showing abnormal wood. Natural size.

treatment of chronic bronchitis. The infusion and the tincture are the preparations most commonly employed.

**Infusum Senegæ.** Contains the active principles of 1 ounce of senega root in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Liquor Senegæ Concentratus.**—Contains the active principles of 1 ounce of root in 2 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Senegæ.**—Contains the active principles of 1 ounce of root in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

#### SARSAPARILLA

**Sarsæ Radix.**—‘The dried root of *Smilax ornata*, *Hook. f.* Imported from Costa Rica, and commonly known as Jamaica sarsaparilla.’

*Characters.*—Usually imported in nearly cylindrical bundles about 18 inches long and  $4\frac{1}{2}$  inches broad, consisting



FIG. 45.

A bundle of Sarsaparilla as imported.  $\frac{1}{4}$  linear.

of long slender roots, folded together and loosely bound with one of the same roots. The roots are dark reddish-brown or greyish-brown in colour, tough and flexible,  $\frac{1}{8}$  to  $\frac{3}{16}$  inch thick, roughly cylindrical, but marked with deep longitudinal furrows, and give off numerous rootlets. They should show

no transverse cracks. The transverse section exhibits a narrow reddish-brown bark, and a yellowish-white wood and pith. It has no distinctive odour; when chewed for a short time it has an acrid taste.



FIG. 46.

A small portion of the root. Natural size.

The microscopic appearance of the endodermal cells as seen in transverse section—nearly square and uniformly thickened—is often an important feature in distinguishing the official from other varieties of sarsaparilla.

*Chief Constituents.*—Three saponins—**sarsaponin**, parillin, both crystalline; smilasaponin, amorphous. Sarsaponin is the most active. A trace of volatile oil, resin, &c.

*Pharmacology.*—Its action is slight and is dependent mainly on the saponins it contains. It has been given, combined with other remedies, in syphilis and chronic rheumatism, but it has probably no beneficial action.

**Extractum Sarsæ Liquidum.**—Contains the principles of 1 ounce of sarsaparilla in 1 fluid ounce.

It also contains glycerin (1 in 10 by volume).

*Dose.*—2 to 4 fluid drachms.

**Liquor Sarsæ Compositus Concentratus.**—A liquor prepared from sarsaparilla, sassafras root, guaiacum wood, dried liquorice root, and mezereon bark.

Sarsaparilla, 20 oz.; sassafras root, 2 oz.; guaiacum wood, 2 oz.; dried liquorice root, 2 oz.; mezereon bark, 1 oz.; alcohol (90 per cent.), 4½ fl. oz.; distilled water, to make 20 fl. oz.



*Dose.*—2 to 8 fluid drachms.

*Pharmacology.*—It has no action of importance. The liquorice root gives it a somewhat pleasant taste. It is employed mainly as an excipient for potassium iodide.

#### HEMIDESMUS ROOT

**Hemidesmi Radix**—Indian sarsaparilla. ‘The dried root of *Hemidesmus indicus*, *R.Br.*’

*Characters.*—Long, rigid, somewhat tortuous,  $\frac{1}{16}$  to  $\frac{1}{4}$  inch in diameter, dark brown or reddish-brown, longitudinally furrowed, and marked at intervals by deep transverse cracks. On one side the cork is frequently separated from the cortex,



FIG. 47.

Two pieces of hemidesmus root. Natural size.

and the whole bark may be easily detached from the wood. The transverse section shows a greyish bark and a large yellowish wood. The odour is slight but fragrant, resembling Tonquin beans; the taste is somewhat sweetish and aromatic.

*Chief Constituents.*—A saponin which has not been isolated, but is often termed hemidesmin; coumarin, which gives it the fragrant odour; tannin in the bark.

*Pharmacology.*—It has very little action. It has been used for the same purposes as sarsaparilla, but is rarely employed in this country.

**Syrupus Hemidesmi.**—Contains approximately the active ingredients of 1 ounce of hemidesmus root in 8 ounces.

Hemidesmus root, 4 oz.; sugar, 28 oz.; distilled water, 20 fl. oz.  
The product should weigh 42 oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has no action of importance. It may be used as a flavouring agent.

### GLUCOSIDES POSSESSING A PURGATIVE ACTION

Four official drugs, which are used chiefly as purgatives, owe their action to the glucoside or glucosides contained in them. These are jalap, scammony root, colocynth pulp, and euonymus bark. Senna and rhubarb root also contain purgative glucosides, and aloin, the active ingredient in aloes, is said to be a glucoside, but as its glucosidal nature has not been confirmed, and as the glucosides of senna and rhubarb root are probably not the most active principles, these drugs are better described in a separate group.

The changes which the active principles undergo in the alimentary canal are not well understood. But the alkalinity of the intestinal contents appears to play an important part. Thus in the absence of bile these drugs are much less active than normally, whereas, after treatment with an alkali their activity returns to a greater or less extent. In the case of the glucosides of jalap and scammony root, which yield on hydrolysis resin acids, the probable active agent is the alkali salts of these.

There is reason to believe that these acids exist in the drug as lactones or acid-anhydrides, but the question is not of sufficient importance to be dealt with here.

*Pharmacological Action.*—Speaking generally, the action of these substances is an irritant action. In therapeutic doses they produce little or no irritation in the stomach, but after passing into the intestines they are dissolved, if previously

insoluble, and are gradually decomposed as they pass down the intestinal tract by the alkaline contents of the intestine; irritation of the mucous membrane of the bowel occurs, producing increased secretion and peristalsis, and finally an evacuation. As the fæces are normally 'formed' in the large intestine, the chief action is exerted on this portion.

Purgatives differ both as regards the time they take to act and the consistence of the evacuation they produce. The members of this group have, for vegetable purgatives, a rapid action. They also produce a watery evacuation.

When a purgative action follows, practically no absorption of the drug occurs, and therefore no general symptoms are produced, but after large doses acute irritation both of the stomach and bowels may follow, and reflex effects may result from this cause.

The commonest ill-effect produced by purgatives is colic. This is due to irregular peristalsis, and it is generally produced by the members of this group. Consequently they are always combined with a carminative.



FIG. 48.

Two jalap tubercles, showing different shapes. Natural size.

#### JALAP

**Jalapa.**—‘The dried tubercles of *Ipomœa Purga*, *Hayne*.’ They ‘should yield not less than 9 nor more than 11 per cent. of resin having the properties of the official Resin.’

*Characters.* — Hard, heavy tubercles, of varying size, but usually from 1 to 3 inches in length, ovoid, napiform, or fusiform in shape, dark brown in colour, furrowed and wrinkled in appearance, and usually marked by small transverse scars. Large tubercles are frequently incised to

facilitate drying. The transverse section is brownish or yellowish-grey in colour, horny, but sometimes softish in consistence; and shows no distinct structure beyond irregular dark lines usually arranged concentrically. The odour is characteristic; the taste is at first sweet, then acrid.

*Active Principle.*—The official resin, which consists of **convolvulin** (jalapin) about 90 per cent., and **scammonin** about 10 per cent.

Convolvulin is a white amorphous powder soluble in alcohol, but insoluble in water or ether. Alkalies gradually decompose it and form methyl-ethyl-acetic acid and two glucosidal acids—purgic acid and convolvulic acid. Convolvulic acid is decomposed by dilute acids into glucose and convolvulinolic acid.

Scammonin occurs as a transparent amorphous mass. It is soluble in alcohol and in ether, and very slightly in water. It dissolves in cold alkaline solutions, and is therefore believed to be the anhydride of scammonic acid. Scammonic acid breaks up under the influence of dilute acids into a sugar and scammonolic acid. Scammonolic acid is probably a derivative of hexadecylic acid; convolvulinolic acid of pentadecylic acid.

*Dose.*—5 to 20 grains.

*Pharmacology.*—Jalap in the form of fine powder is irritant to mucous membranes. If sniffed it produces sneezing, and taken in full pharmacopœial doses is liable to produce nausea, although usually it is well borne. On reaching the intestines it irritates the mucous membrane, and produces distressing colic and a copious watery evacuation of the bowels in about 3 hours. Bile is necessary for its action. It is rarely used except in the form of its preparations.

**Extractum Jalapæ.**—A mixed alcoholic and watery extract of jalap.

*Dose.*—2 to 8 grains.

*Pharmacology.*—In pharmacopœial doses it produces colic and a watery evacuation of the bowels. It is not much employed, and should not be given alone.

**Tinctura Jalapæ.**—Contains 1·5 per cent. of jalap resin.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action, in pharmacopœial doses,



is similar to that of the extract. It is an unnecessary preparation.

**Pulvis Jalapæ Compositus.**—Consists of jalap 5, acid potassium tartrate 9, ginger 1.

*Dose.*—20 to 60 grains.

*Pharmacology.*—It produces a copious watery evacuation of the bowels in 2 to 4 hours, usually without pain. The ginger acts as a carminative, and counteracts the griping tendency of the jalap. The acid potassium tartrate aids the effect of the jalap by acting as a saline purgative. The diuretic effect sometimes observed after the administration of this powder is probably due to absorption of a portion of this salt, which stimulates the kidneys during the process of excretion.

It is used largely as a so-called hydrogogue purgative in the treatment of dropsy, especially dropsy due to kidney disease, and it is also given in chronic Bright's disease to aid elimination of waste products and prevent the onset of uræmia.

**Pulvis Scammonii Compositus.**—Contains 3 of jalap in 8. See page 386.

### **Jalapæ Resina.**

Prepared by extracting jalap with alcohol, adding distilled water to the tincture thus obtained, evaporating off the alcohol, washing the residual deposit, and drying.

*Characters.*—Dark-brown, brittle, opaque pieces, translucent in thin fragments, or a light-brown powder, with a sweetish odour but a somewhat acrid taste. Insoluble in water, but soluble in alcohol.

Not more than 10 per cent. should be soluble in ether (distinction from scammony resin and certain other resins). The Pharmacopœia gives a test to show the absence of guaiacum resin.

*Dose.*—2 to 5 grains.

*Pharmacology.*—Its action is similar to that of jalap, the active principle of which it is. It may be employed

in combination with other substances as a purgative pill for occasional use.

**Pilula Scammonii Composita.**—See page 386.

#### SCAMMONY ROOT

Besides scammony root, a gum-resin scammonium, obtained by incision of the living root, is also official. This must be distinguished from scammony resin obtained from the dried root.

**Scammoniæ Radix.**—‘The dried root of *Convolvulus Scammonia*, *Linn.*’

*Characters.*—Nearly cylindrical, more or less twisted roots, usually of large size, often reaching 3 to 4 inches in diameter, pale brownish-grey in colour, longitudinally fur-



FIG. 49.

Scammony root and section.  $\frac{1}{3}$  linear. Specimens are often much larger.

rowed, and somewhat enlarged at the crown, which bears the scars or remains of slender aerial stems. The fracture is coarsely fibrous. The transverse section is greyish in colour, and shows a characteristic arrangement of the wood, which is separated into distinct irregular bundles. The odour is slight, but characteristic; the taste at first sweetish, afterwards somewhat acrid.

*Active Principle.*—The official resin (about 5 per cent.) which consists almost entirely of a glucosidal resin, **scammonin** (see page 383).

It is used only to prepare the resin.

#### **Scammoniæ Resina.**

Prepared by exhausting scammony root with alcohol, evaporating off most of the alcohol, slowly pouring the residual liquid into three

times its bulk of distilled water, constantly stirring, washing the deposited resin, and drying on a water-bath.

*Characters.*—Brownish, brittle, translucent pieces, with a somewhat fragrant odour, and a sweetish, afterwards acrid, taste. Insoluble in and immiscible with water, soluble in alcohol and in ether (compare jalap resin).

Tests are given in the Pharmacopœia to show the absence of guaiacum resin.

*Dose.*—3 to 8 grains.

*Pharmacology.*—Its action is similar to that of jalap resin, but it is said to be more powerful and to produce more griping. It is rarely employed except in combination with other remedies.

**Pilula Scammonii Composita.**—Contains about  $\frac{1}{4}$  of scammony resin,  $\frac{1}{4}$  of jalap resin, and ginger.

Scammony resin, 1 oz.; jalap resin, 1 oz.; eurd soap, 1 oz.; tincture of ginger, 3 fl. oz. Mix, and evaporate on a water-bath to a suitable consistence.

*Dose.*—4 to 8 grains.

*Pharmacology.*—It produces a brisk purgative action, sometimes accompanied by pain. It is used in occasional constipation, and as a so-called vermifuge to expel intestinal worms after they have been killed or detached by liquid extract of male fern or other remedies. It may be employed for the same purposes as compound powder of jalap.

**Pulvis Scammonii Compositus.**—Consists of scammony resin 4, jalap 3, ginger 1.

*Dose.*—10 to 20 grains.

*Pharmacology.*—It produces a watery evacuation of the bowels, and is used in place of compound jalap powder when a more powerful effect is required.

**Scammonium.**—‘A gum-resin obtained by incision from the living root of *Convolvulus Scammonia*, *Linn.* Known in commerce as virgin scammony.’

*Characters.*—Flattened cakes, 4 to 5 inches in diameter and  $\frac{1}{2}$  to 1 inch thick, or irregular fragments, dark-grey to brown or nearly black in colour, but usually covered with a greyish powder. It is brittle. The fractured surface generally has a porous appearance, is dark brown or nearly black in colour, and somewhat glossy. Thin fragments are translucent and brownish in colour. It is easily reduced to an ash-grey powder, which, when triturated with water, forms an emulsion (compare scammony resin). The odour is

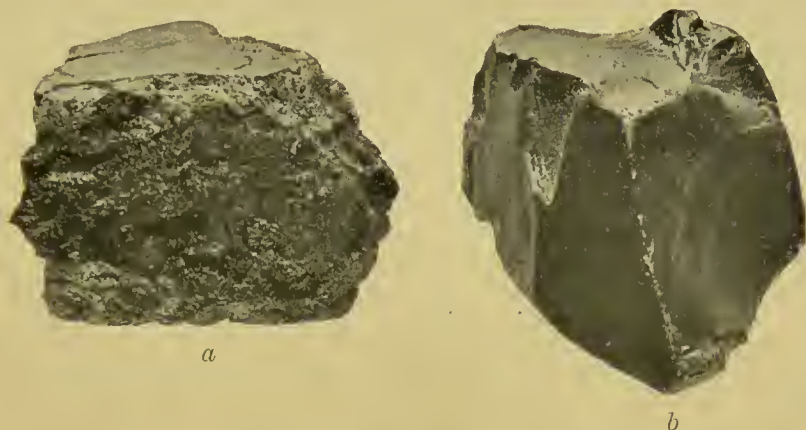


FIG. 50.

(a) Scammonium, showing porous nature. (b) Scammony resin.  
Natural size.

characteristic (often described as somewhat cheesy), the taste acrid.

It should contain not less than 70 per cent. of resin soluble in ether, nor more than 3 per cent. of mineral matter, and no starch or guaiacum resin.

*Constituents.*—The resin (about 80 per cent.) and gum. It is frequently adulterated.

*Dose.*—5 to 10 grains.

*Pharmacology.*—Its action is similar to that of scammony resin. It is an unnecessary drug, and very rarely prescribed.

## COLOCYNTH

**Colocynthis Pulpa.**—‘The dried pulp of the fruit of *Citrullus colocynthis*, *Schrad.*, freed from seeds.’



*Characters.*—The pulp is light, spongy, somewhat pith-like in texture, of a cream colour, without odour, but with a very bitter taste. It is usually seen in the form of more or less broken balls,  $1\frac{1}{2}$  to 2 inches in diameter, containing the

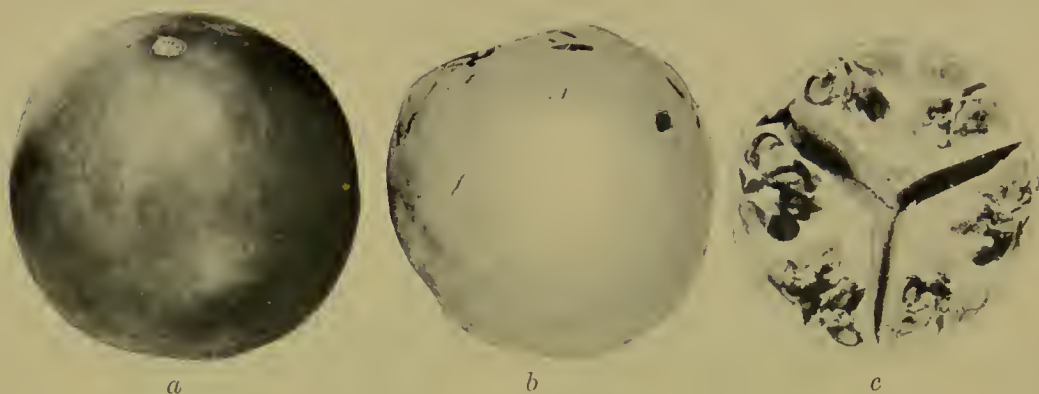


FIG. 51.

Colocynth: (a) unpeeled fruit; (b) peeled fruit; (c) transverse section of peeled fruit, showing seeds.  $\frac{1}{2}$  linear. The pulp alone is official.

seeds, owing to the fruit being merely peeled before exportation. The seeds are separated from the pulp before it is used.

It should not contain starch or more than traces of fixed oil.

*Active Principle.*—**Colocynthin**, an amorphous, yellow, bitter glucoside, which can be decomposed into a resinous substance, colocynthein and sugar.

Colocynthein has a more powerful pharmacological action than colocynthin. Other resinous substances—colocynthitin, citrullin—have been described, but are of no importance.

*Pharmacology.*—Its bitter action is unimportant, since it is almost invariably given in the form of pills. Administered in this way it produces marked griping and a watery evacuation of the bowels. It is generally administered combined with other purgatives, and always with a carminative.

**Extractum Colocynthidis Compositum.**—Contains the active principle of colocynth pulp 6 ounces; and extract of Barbados aloes 12 ounces, scammony resin 4 ounces, curd soap 4 ounces, cardamom seeds 1 ounce.

*Dose.*—2 to 8 grains.

*Pharmacology.*—It produces a good purgative effect, frequently, however, accompanied by griping. It is rarely given alone, but is used in combination with other purgatives and carminatives.

**Pilula Colocynthis Composita.**—Contains colocynth pulp 1, Barbados aloes 2, scammony resin 2, oil of cloves  $\frac{1}{4}$ , in about 6.

*Dose.*—4 to 8 grains.

*Pharmacology.*—It is a good pill for occasional constipation, but it often produces colicky pains, and is consequently more frequently prescribed in the form of the following preparation.

**Pilula Colocynthis et Hyoscyami.**—Consists of compound pill of colocynth 2, extract of hyoscyamus 1.

*Dose.*—4 to 8 grains.

*Pharmacology.*—The extract of hyoscyamus prevents the griping produced by the colocynth pill. The pill is largely used for occasional constipation. It is not suitable for regular use in habitual constipation.

#### EUONYMUS BARK

**Euonymi Cortex.**—‘The dried root-bark of *Euonymus atropurpureus*, *Jacquin*.’

*Characters.*—Small quilled or curved pieces,  $\frac{1}{12}$  to  $\frac{1}{6}$  inch thick. The cork is somewhat spongy and friable, light ash-grey in colour, but marked with darker patches due to adhering earth. The inner surface is a cream or pale-buff colour, and smooth, except where there are patches of adhering white wood. The fracture is short; if broken carefully, fine silky threads may be noticed passing between the pieces.



FIG. 52.

Euonymus bark. Natural size.

The odour is faint, but characteristic; the taste is bitter and somewhat acrid.

*Active Principles.*—**Euonymin**, a crystalline glucoside, and probably other principles.

Commercial euonymin is a powdered extract of the bark.

*Pharmacological Action.*—Crystalline euonymin has an action on the heart resembling digitalis, but it is not employed in therapeutics. The bark is a mild bitter, and it has been accredited with diuretic and antiperiodic actions, but if these exist they are of no importance. It is used solely for its action on the intestine (see below).

**Extractum Euonymi Siccum.**—A dried alcoholic extract of euonymus bark mixed with  $\frac{1}{4}$  its weight of calcium phosphate.

As it is hygroscopic and tends to decompose, it should be kept in well-stoppered bottles.

*Dose.*—1 to 2 grains.

*Pharmacology.*—It is generally said to increase the secretion of the bile, but it probably acts only as a cholagogue purgative. Pharmacopœial doses are usually insufficient to cause purgation, but they stimulate the upper part of the intestine, and their effect is completed by the subsequent administration of a saline or mercurial purge. They are mainly used in the treatment of constipation with pale stools. Larger doses produce purgation, but this is associated with severe colic, and consequently they are not used.

## OTHER DRUGS YIELDING GLUCOSIDES

### BEARBERRY LEAVES

**Uvæ Ursi Folia.**—‘The dried leaves of *Arctostaphylus Uva-ursi*, *Spreng.*’

*Characters.*—Shining coriaceous leaves, about  $\frac{3}{4}$  inch long, obovate or spatulate in shape, with an entire slightly

revolute margin, and shortly petiolate. The upper surface is yellowish-green in colour and reticulated, the veinlets being depressed. The under surface is paler and greyish-green. The leaves have no distinctive odour, but have a very astringent taste.

Compare with Buchu leaves (page 492).

*Chief Constituents.*—**Arbutin**, methyl-arbutin, both crystalline bitter glucosides; **tannin** (6 to 7 per cent.).

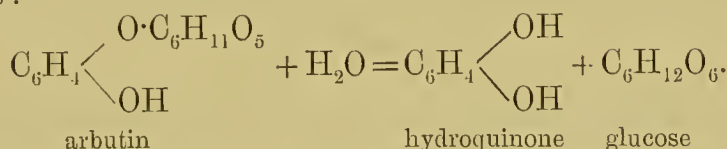


FIG. 53.

Other substances—ericolin (a glucoside), urson (a crystalline substance), ellagic and gallic acids—occur, but are not important.

Bearberry leaves. (a) Upper, (b) under surface. Natural size.

Arbutin is decomposed by emulsin or dilute acids as follows :



Methyl-arbutin undergoes a similar decomposition, but yields methyl-hydroquinone in place of hydroquinone.

*Pharmacology.*—It is astringent owing to the tannin it contains, but its main action is due to the glucosides arbutin and methyl-arbutin. These are mildly antiseptic, and during their excretion by the urine exert an antiseptic action. They also stimulate the kidneys slightly, and act as mild diuretics. They are excreted, in the main, unchanged; a small portion is broken up in the body, probably in the intestine, into glucose and hydroquinone, and the urine may be consequently somewhat dark in colour. If the urine is allowed to stand for some time, more arbutin is decomposed, and the urine darkens further. Large amounts of bearberry leaves are apt to irritate the alimentary canal.

**Infusum Uvæ Ursi.**—Contains the active ingredients of 1 ounce of bearberry leaves in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.



*Pharmacology.*—It is used as a mild stimulant and urinary antiseptic in the treatment of inflammatory conditions of the urinary tract (pyelitis, cystitis, &c.).

#### LIQUORICE ROOT

**Glycyrrhizæ Radix.**—‘The peeled root and peeled subterranean stem of *Glycyrrhiza glabra*, *Linn.*, and other species.’

*Characters.*—Long, roughly cylindrical, yellowish pieces with a nearly smooth fibrous surface. The unpeeled root has a dark-brown cortex, longitudinally wrinkled, but not scaly.

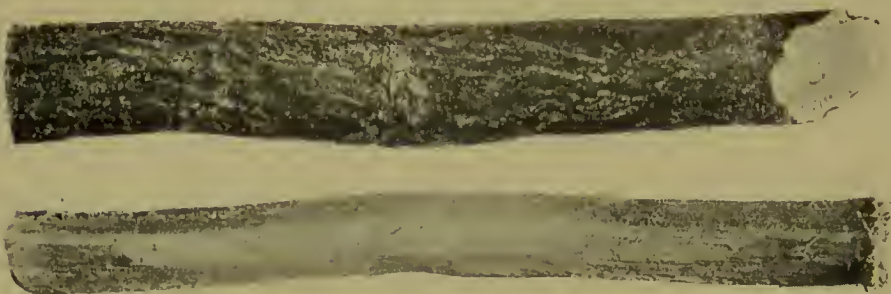


FIG. 54.

Liquorice root: unpeeled (not official), showing radiate structure of section; peeled, showing fibrous fracture. Natural size.

The fracture is coarsely fibrous. The transverse section shows a yellow, distinctly radiate, wood, and, in unpeeled specimens, a moderately thick bark. The odour is faint, but characteristic; the taste is sweet and characteristic, and free from bitterness or acidity.

Russian liquorice root has a slightly bitter taste. The cortex of unpeeled specimens is also somewhat scaly.

*Chief Constituents.*—**Glycyrrhizin**, a yellow amorphous glucoside (4 to 8 per cent.). Sugar.

Glycyrrhizin is a compound of ammonia and glycyrrhizic acid. The acid, which has been obtained in a crystalline form, decomposes on boiling with dilute mineral acids into glucose and glycyrrhetin (a bitter resinous substance). It forms, with alkalis, crystalline salts, which are very sweet.

*Pharmacology.*—It is demulcent, but is used mainly as a flavouring agent. It is useful for covering the taste of saline and bitter medicines.

**Extractum Glycyrrhizæ.**—An aqueous extract.

It is used in making Confectio Sennæ and Decoctum Aloes Compositum.

*Pharmacology.*—It is demulcent, and in large quantities slightly laxative. In a dry form, as lozenges, it is employed to diminish the irritability of a sore throat.

**Extractum Glycyrrhizæ Liquidum.**—A strong solution of the active ingredients of liquorice root.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

It is contained in Mistura Sennæ Composita and in Tinctura Aloes.

*Pharmacology.*—It is used chiefly to cover the taste of bitter and saline mixtures. As glycyrrhizin is precipitated by acids, it should not be used if acid is present. Strong saline solutions may also precipitate it unless alkali is added.

**Pulvis Glycyrrhizæ Compositus.**—See page 403.

**Liquor Sarsæ Compositus Concentratus.**—See page 379.

Gentian root and bitter-orange peel also contain glucosides. They are described later (pages 459, 461) with the drugs to which, pharmacologically, they are most closely allied.

## DRUGS CONTAINING ACTIVE PRINCIPLES WHICH ARE DERIVATIVES OF ANTHRACENE.

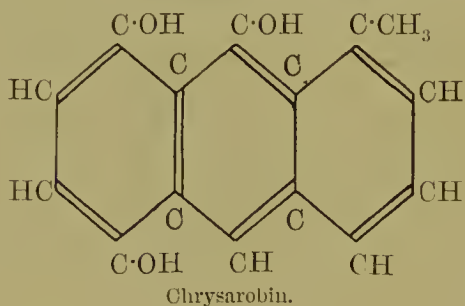
THIS class includes Goa powder and the official substance, chrysarobin, derived from it, rhubarb root, senna, cascara sagrada, and aloes. Senna, rhubarb root, and aloes might have been included among the glucosides (page 381), but as their action is probably due in the main to derivatives of anthracene, they are better considered here.

The active principle of cascara sagrada is not definitely known, but is probably an anthracene derivative.

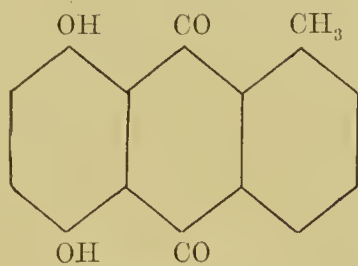
All the drugs of this group, with the exception of Goa powder and its active constituent, chrysarobin, are used mainly as purgatives. Their purgative action is due largely to the fact that, under the influence of the alkaline juices of the intestines, the active principles are converted into irritant substances which stimulate the intestinal mucous membrane, and thus induce increased secretion and a more active peristalsis. They are, for the most part, slower in action, and produce a less watery evacuation than jalap or scammony.

The main, if not the sole, active principle of Goa powder is a yellow crystalline substance, soluble in hot chloroform and official under the name chrysarobin. This consists of pure chrysarobin ( $C_{15}H_{12}O_3$ ), di-chrysarobin-methyl-ether ( $C_{30}H_{23}O_7 \cdot CH_3$ ), and small quantities of di-chrysarobin ( $C_{30}H_{24}O_7$ ), and an unnamed substance ( $C_{17}H_{14}O_4$ ). It does not contain chrysophanic acid, although readily oxidised to it.

Chrysarobin is the anthranole of ehrysophanic acid, and is readily oxidised to chrysophanic acid. It occurs in lemon-yellow scales, melting at  $202^{\circ}C.$ , which are practically insoluble in water.

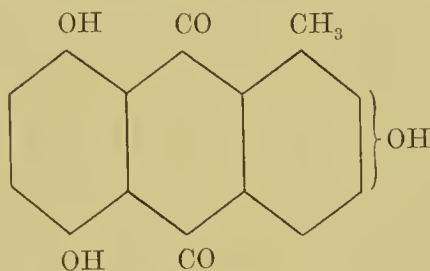


Chrysophanic acid is 5,8-dioxy-1-methyl-anthraquinone. It is a yellow crystalline powder, melting at 160°C., and almost insoluble in water, but soluble in ether and boiling alcohol. It readily dissolves in solutions of caustic alkalies, producing a dark-red colour, but is only slightly soluble in solutions of ammonia or alkali carbonates.



Chrysophanic Acid.

Emodin, which is generally regarded as an active principle of some of these drugs (cascara sagrada, rhubarb root), is believed to be 3,5,8-trioxy-1-methyl-anthraquinone. It is insoluble in water, and it has been doubted recently if it is an active ingredient.



Emodin.

Aloin, the active principle of aloes, is certainly a derivative of anthracene, and is believed to be a glucoside. Barbaloin is said to be a condensation product of methyl-isoxychrysin and methyl-aldopentose.<sup>1</sup>

## GOA POWDER

**Araroba**—Goa powder. ‘A substance found in cavities in the trunk of *Andira Araroba*, *Aguilar*., freed as much as possible from fragments of wood, dried, and powdered.’

It is a pathological product, and arises from the breaking down of the walls of cells and vessels.

*Characters*.—A powder varying in colour from brownish-yellow to umber-brown, which should give, when extracted

<sup>1</sup> Recent work has not confirmed this statement.



with hot chloroform, not less than 50 per cent. of official chrysarobin.

It is used only to prepare chrysarobin.

**Chrysarobin.**—The Pharmacopœia states that ‘it consists chiefly of a definite chemical substance also known as chrysarobin, but contains a varying proportion of chrysophanic acid.’ Recent research has shown that it is a mixture of substances, and contains no chrysophanic acid (see page 394).

It is obtained by extracting araroba with hot chloroform.

*Characters.*—A yellow crystalline powder, without odour or taste. Almost insoluble in water, soluble in hot alcohol and hot chloroform and in ether. It partially dissolves in solution of caustic potash, with the formation of a deep brownish-red solution.

After incineration it should leave not more than 1 per cent. of ash.

*Pharmacology.*—It is irritant. If applied to the eye it causes severe conjunctivitis. Taken by the mouth (5 to 10 grain doses), it produces gastro-intestinal irritation. A small portion is absorbed, and may irritate the kidneys. It is excreted mainly in the urine, and colours it yellow if acid, or reddish if alkaline.

Strong ointments (10 to 20 per cent.) irritate the skin and may produce inflammation. Weak ointments (2 per cent. or less) are stimulant. The ointments stain the skin a brownish colour, which is increased by alkalies (*e.g.* soap), and this sometimes forms an objection to their use.

Weak ointments are used in the treatment of scaly skin diseases, especially psoriasis. Stronger ointments (5 to 10 per cent.) are used for troublesome ringworm.

**Unguentum Chrysarobini.**—Consists of chrysarobin 1, benzoated lard 24.

## RHUBARB ROOT

**Rhei Radix.**—‘The erect rhizome or so-called root of *Rheum palmatum*, *Linn.*; *Rheum officinale*, *Baill.*; and probably other species; collected in China and Thibet, deprived of more or less of its cortex, and dried.’

*Characters.*—Conical, barrel-shaped, or more or less irregular pieces, often about 3 to 4 inches in length and  $1\frac{1}{2}$  to 2 inches in diameter, usually smooth and covered with a bright-yellow powder, firm in texture, and frequently bored with a hole which may contain a piece of the string used to suspend the drug while drying. The surface, if scraped, is seen to be marked by reddish-brown and whitish lines, arranged for the most part longitudinally, which give to it a marble-like appearance. The fracture is uneven and granular and presents an appearance similar to that of the surface. The odour is characteristic; the taste is feebly astringent and bitter, and a gritty sensation is experienced when the root is chewed, owing to the presence of calcium oxalate.

*Active Principles.*—An **amorphous resinous substance** (cathartic acid ?, 3 to 4 per cent.); **chrysophanic acid**; **emodin**; **rheo-tannic acid**; a **bitter substance**.

A trace of volatile oil is present, and various colouring matters and two gluco-tannoids—glucogallin and tetrarin—have been isolated. Calcium oxalate occurs in variable amounts.

*Dose.*—3 to 10 grains for repeated administration; 15 to 30 grains for a single administration.



FIG. 55.

Rhubarb root. The upper part has been scraped to show network of whitish lines.  $\frac{3}{4}$  linear.

*Pharmacology*.—In small doses its action is mainly that of a bitter (see page 453), in large doses that of a purgative. The purgative effect is somewhat slow and variable, and usually accompanied by griping. It is followed by more distinct constipation than other purgatives owing to the tannic acid the root contains. A variable portion is absorbed, and is excreted mainly in the urine, which it colours yellow (changed to a reddish colour if made alkaline).

Small doses are given in atonic dyspepsia, especially when accompanied by constipation. Purgative doses are given to children, and are particularly useful in the treatment of diarrhoea due to abnormal feeding, the astringent after-effect being valuable in such cases. On account of its astringent action it is not adapted for continued use in chronic constipation. It is rarely administered alone.

**Extractum Rhei.**—An alcoholic extract.

*Dose*.—2 to 8 grains.

*Pharmacology*.—Useful as a purgative in combination with other substances.

**Infusum Rhei.**—Contains the active principles of 1 ounce of rhubarb root in 20 fluid ounces.

*Dose*.— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology*.—Employed as an excipient for other stomachic and purgative medicines.

**Liquor Rhei Concentratus.**—Contains the active ingredients of 1 ounce of rhubarb root in 2 fluid ounces.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—It may be regarded as a concentrated infusion and used as such.

**Pilula Rhei Composita.**—Contains a little more than 1 grain of Socotrine aloes and nearly  $1\frac{1}{2}$  grains of rhubarb root in 5 grains. It also contains myrrh and oil of peppermint.

Rhubarb root, 3 oz.; Socotrine aloes,  $2\frac{1}{4}$  oz.; myrrh,  $1\frac{1}{2}$  oz.; hard soap,  $1\frac{1}{2}$  oz.; oil of peppermint,  $1\frac{1}{2}$  fl. dr.; syrup of glucose,  $2\frac{3}{4}$  oz.

*Dose.*—4 to 8 grains.

*Pharmacology.*—It is a useful purgative pill. Its action is due to the rhubarb and the aloes. The oil of peppermint and the myrrh act as carminatives.

**Pulvis Rhei Compositus**—Gregory's powder. Consists of rhubarb root 2 ; light magnesia 6 ; ginger 1.

Heavy magnesia may be employed if desired.

*Dose.*—20 to 60 grains.

*Pharmacology.*—It combines the purgative effects of rhubarb and magnesia. The ginger acts as a carminative. It is given as a purgative medicine to children, and is best administered as a mixture. Its taste is unpleasant.

**Syrupus Rhei.**—Contains the active principles of 1 of rhubarb root and 1 of coriander fruit in 20 by weight, or, approximately, 15 by volume.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—A purgative syrup, useful for children.

**Tinctura Rhei Composita.**—Contains the active principles of 1 ounce of rhubarb root in 10 fluid ounces. It also contains cardamom seeds, coriander fruit, and glycerin.

Rhubarb root, 2 oz. ; cardamom seeds,  $\frac{1}{4}$  oz. ; coriander fruit,  $\frac{1}{4}$  oz. ; glycerin, 2 fl. oz. ; alcohol (60 per cent.), to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm for repeated administration ; 2 to 4 fluid drachms for a single administration.

*Pharmacology.*—It is the preparation of rhubarb commonly employed in the treatment of gastric disorders. It is also the best liquid preparation to use as a purgative, although it is rarely employed for this purpose. The cardamom seeds and coriander fruit act as carminatives.

## SENNA

Two varieties of senna are official. Either may be used for making the official preparations.



**Senna Alexandrina**—Alexandrian senna. ‘The dried leaflets of *Cassia acutifolia*, *Delile*.’

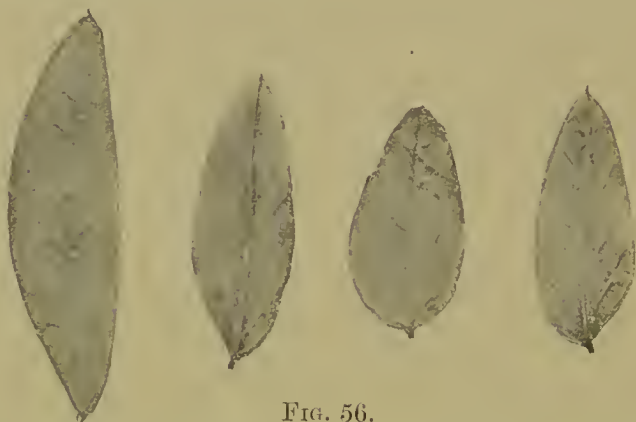


FIG. 56.

Alexandrian Senna. The first and third leaflets show the upper surface; the second and fourth the under surface. Natural size.

**Senna Indica**—East Indian or Tinnivelly senna. ‘The dried leaflets of *Cassia angustifolia*, *Vahl*. From plants cultivated in Southern India.’



FIG. 57.

East Indian or Tinnivelly Senna, showing different sizes. The first, third, and fifth leaflets show the upper surface; the second, fourth, and sixth the under surface. Natural size.

*Characters*.—Both sennas consist of thin leaflets which are lanceolate in shape, have an entire margin, an acute apex,

and are unequal at the base. They have a faint characteristic odour and an unpleasant mucilaginous and bitter taste.

East Indian or Tinnivelly senna is most frequently met with in commerce. The leaflets are larger (1 to 2 inches in length), flatter (because more carefully packed), firmer in texture, more uniformly lanceolate, and less unequal at the base than those of Alexandrian senna. They are yellowish-green in colour, and glabrous, or nearly so.

Alexandrian senna is greyish-green in colour, and usually presents a broken appearance. The leaflets are  $\frac{3}{4}$  to  $1\frac{1}{4}$  inch long, are often oval-lanceolate in shape, the greatest diameter of the leaflet being frequently below the middle, and are usually finely pubescent.

Senna fruits or pods, although not official, are frequently used. They are flat legumes, and contain several flat seeds.



FIG. 58.  
Senna pod.  
Natural size.

*Chief Constituents.*—**Cathartic acid**, an amorphous glucoside; **chrysophanic acid** (see page 395); **emodin** (see page 395).

Cathartic acid has probably not been obtained pure. It may be decomposed into glucose and cathartogenic acid.

Two other glucosides have been described; and the drug also yields small quantities of a volatile oil, resin, sugar, &c.

*Pharmacology.*—Senna has an unpleasant bitter nauseous taste, but is generally well borne by the stomach. In sufficient doses it produces a watery evacuation of the bowels in about five or six hours. Its action is accompanied by marked griping, hence all the official preparations contain a carminative.

**Infusum Sennæ.**—Contains the active principles of 1 ounce of senna and a small quantity of ginger in 10 fluid ounces.

Senna, 2 oz.; ginger, 55 gr.; boiling distilled water, 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce; as a draught, 2 fluid ounces.

*Pharmacology.*—It is a useful active excipient for aperient medicines. It may be used as a draught for

occasional constipation, but the following preparation is better :

**Mistura Sennæ Composita** — black draught. Consists of magnesium sulphate 5 ounces ; liquid extract of liquorice 1 fluid ounce ; compound tincture of cardamoms 2 fluid ounces ; aromatic spirit of ammonia 1 fluid ounce ; infusion of senna to make 20 fluid ounces.

*Dose as a draught.*—1 to 2 fluid ounces.

*Pharmacology.*—It is a quickly acting aperient. The effect is due to the magnesium sulphate and infusion of senna. The liquid extract of liquorice partially covers the unpleasant taste ; the compound tincture of cardamoms and aromatic spirits of ammonia act as carminatives. It is a useful aperient in occasional constipation or whenever it is necessary to clear out the bowels.

**Liquor Sennæ Concentratus.**—Contains the active ingredients of 1 ounce of senna and a little ginger in 1 fluid ounce.

Senna, 20 oz. ; tincture of ginger,  $2\frac{1}{2}$  fl. oz. ; alcohol (90 per cent.), 2 fl. oz. ; distilled water, to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action and uses are similar to those of the infusion. It may be regarded as a concentrated infusion.

**Tinctura Sennæ Composita.**—Contains the active principles of 1 ounce of senna, with flavouring and carminative agents, in 5 fluid ounces.

Senna, 4 oz. ; raisins freed from seeds, 2 oz. ; caraway fruit,  $\frac{1}{2}$  oz. ; coriander fruit,  $\frac{1}{2}$  oz. ; alcohol (45 per cent.), 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm for repeated administration ; 2 to 4 fluid drachms for a single administration.

*Pharmacology.*—A somewhat more pleasant preparation than the infusion. It is used as a bitter and laxative in atonic dyspepsia and other conditions.

**Confectio Sennæ.**—A complex preparation containing 1 of senna in 10½. The other ingredients are figs, tamarinds, cassia pulp, prunes, coriander fruit, extract of liquorice, and sugar.

Senna, 7; coriander fruit, 3; figs, 12; tamarinds, 9; cassia pulp, 9; prunes, 6; extract of liquorice, 1; sugar, 30; distilled water, a sufficient quantity. The product should weigh 75 oz.

*Dose.*—60 to 120 grains.

*Pharmacology.*—A pleasant purgative preparation, used chiefly to administer to children.

**Syrupus Sennæ.**—Contains the active principles of nearly 1 of senna in 2 of syrup by weight. It is flavoured with oil of coriander.

Senna, 40 oz.; oil of coriander, 10 minims; alcohol (90 per cent.), 40 minims; sugar, 50 oz.; alcohol (20 per cent.), 70 fl. oz. The product should weigh 5 lbs. 12 oz.

*Dose.*—½ to 2 fluid drachms.

*Pharmacology.*—This is also a pleasant purgative preparation, readily taken by children.

**Pulvis Glycyrrhizæ Compositus.**—Contains 2 of senna and 1 of sublimed sulphur in 12.

Senna, 2; sublimed sulphur, 1; liquorice root, 2; fennel fruit, 1; sugar, 6.

*Dose.*—60 to 120 grains.

*Pharmacology.*—The senna and sulphur are the active purgative principles; the fennel fruit acts as a carminative and flavouring agent; the liquorice root and sugar are mainly flavouring ingredients.

In pharmacopœial doses it is laxative rather than powerfully purgative. The large bulk of insoluble powder makes it somewhat unpleasant to take, but it is a favourite purgative with many people. It is used in occasional constipation, and in smaller doses repeatedly administered as a mild laxative.



## CASCARA SAGRADA

**Cascara sagrada**—sacred bark. ‘The dried bark of *Rhamnus purshianus*, DC.’

*Characters*.—Quilled, channelled, or flattish pieces, up to 6 inches long, usually about  $\frac{3}{4}$  inch broad, and  $\frac{1}{16}$  to  $\frac{1}{8}$  inch thick. The outer surface is smooth, purplish-brown in colour, and marked with transversely elongated lenticels, but frequently more or less covered with a silvery-grey lichen. The

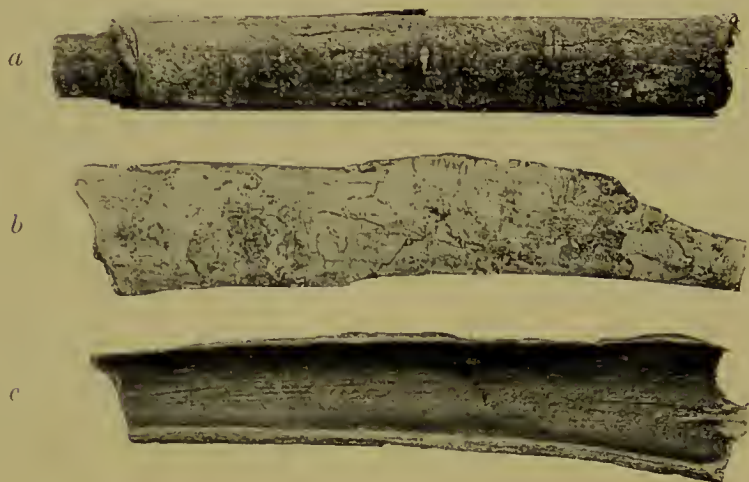


FIG. 59.

Cascara Sagrada. (a) Quill showing lenticels; (b) piece largely covered with lichen; (c) internal surface, showing longitudinal striations.  $\frac{3}{4}$  linear.

inner surface is dark reddish-brown, longitudinally striated, and marked with faint transverse corrugations. The fracture is short, near the inner surface shortly fibrous. The odour is slight but characteristic; the taste is bitter and nauseous.

*Active Principle*.—Not definitely known.

The most active purgative principle is contained in that portion of the lead subacetate precipitate of an alcoholic extract which is soluble in ethyl acetate.

The bark contains emodin and an isomeric substance (iso-emodin?); tannin (2.5 per cent.).

*Pharmacology*.—It is a bitter and a purgative. Its action as a purgative is slow, and is sometimes accompanied

by griping, although this is uncommon after properly apportioned doses. It is used mainly in the treatment of chronic constipation. For this purpose the extract may be given as a pill every evening, or the liquid extract may be administered in small doses three times a day. Whichever method is adopted, the principle is the same. It is first to obtain a regular and just efficient action of the bowels, and then to diminish the dose gradually so long as this is maintained.

**Extractum Cascaræ Sagradæ.**—An aqueous extract.  
*Dose.*—2 to 8 grains.

**Extractum Cascaræ Liquidum.**—Contains the active principles of 1 ounce of cascara sagrada in 1 fluid ounce.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Syrupus Cascaræ Aromaticus.**—Contains 2 of liquid extract in 5, by volume. It is flavoured with bitter orange and cinnamon.

Liquid extract of cascara sagrada, 8 fl. oz.; tincture of orange, 2 fl. oz.; alcohol, 1 fl. oz.; cinnamon water, 3 fl. oz.; syrup, 6 fl. oz.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—It is a pleasanter preparation than the liquid extract, and is often preferred to this in the treatment of habitual constipation. It may also be used for occasional constipation.

## ALOES

Three kinds of aloes are official, and others occur in commerce. They are distinguished by prefixing the name of the country from which they were first, and in most cases still are, exported. They are obtained from various species of aloes, and are all prepared in a similar way. The aloes leaf is cut transversely, and the juice which exudes is collected and dried, probably in all cases, by the aid of heat. According to the mode of drying, an opaque mass (hepatic aloes) or a

glassy mass (vitreous aloes) may be produced. The difference is due to crystals of aloin forming in the mass in one case and not in the other.

The difference, however, is not merely a question of drying, because different kinds of aloins crystallise with greater or less ease. Thus, cap-aloïn crystallises with difficulty, and hence Cape aloes (not official) is almost invariably vitreous.

The varieties of aloes differ somewhat in appearance, odour, and taste, but are most easily distinguished by the colour reaction they give with nitric acid.

**Aloe Barbadosensis**—Barbados aloes. ‘The juice that flows from the transversely cut leaves of *Aloe vera*, *Linn.*, *Aloe chinensis*, *Bak.*, and probably other species, evaporated to dryness.’

It is imported from the West Indian Islands, and is known in commerce as Barbados and Curaçao aloes, but little, if any, is now exported from the Barbados.

*Characters*.—Hard, opaque, reddish-brown or chocolate-brown masses, breaking with a dull, conchoidal fracture, and having a characteristic, disagreeable odour and a nauseous, bitter taste. Not less than 70 per cent. should be soluble in water; almost entirely soluble in 60 per cent. alcohol.

A fragment examined under the microscope shows crystals embedded in a transparent matrix. If the powder is moistened with nitric acid it assumes a crimson colour.

It should contain no Natal aloes.

According to the Pharmacopœia a vitreous variety of Barbados aloes occurs, but it is rarely seen in commerce. A small fragment would show no crystals under the microscope.

*Chief Constituents*.—**Barbaloin** (12 per cent. or more).

Resin (yielding, on hydrolysis, alo-resinotannol and cinnamic acid, about 12 per cent.), emodin (very small quantities); undetermined amorphous substances, one of which is believed to be a glucoside, yielding on hydrolysis, derivatives of anthraquinone; traces of volatile oil.

*Dose*.—2 to 5 grains.

*Pharmacology*.—It is a bitter, but is of little use as such on account of its nauseous taste. It is used almost solely as

a purgative. Its action is very slow, a minimal dose often taking fifteen to eighteen hours or longer to act, and is usually accompanied by griping. It should consequently be combined with a carminative. Small doses produce a laxative effect; moderate and large doses cause a watery evacuation of the bowels. It is absorbed to a slight extent, but rarely produces any distinct general effects (renal irritation has been described). Other actions (pelvic congestion, &c.) attributed to aloes are mainly secondary effects, due to its action on the walls of the intestines, and especially the large intestine.

It is very largely used for constipation, generally in the form of pills. It may be taken regularly without losing its effects, and is consequently of service in habitual constipation. The smallest efficient dose should be employed (it is rarely necessary to exceed 2 grains), and it should be administered early in the evening. For simple constipation it is best combined with some other, more rapidly acting, purgative. Full pharmacopœial doses produce unpleasant rectal irritation, and are rarely, if ever, necessary.

**Extractum Aloes Barbadosis.**—An aqueous extract.

*Dose.*—1 to 4 grains.

*Pharmacology.*—Its action and uses are the same as those of aloes. It is questionable if it possesses any advantages over the crude drug.

**Tinctura Aloes.**—Contains 1 ounce of extract of Barbados aloes in 40 fluid ounces. It is flavoured with liquid extract of liquorice.

Extract of Barbados aloes,  $\frac{1}{2}$  oz.; liquid extract of liquorice, 3 fl. oz.; alcohol (45 per cent.), to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm for repeated administration;  $1\frac{1}{2}$  to 2 fluid drachms for a single administration.

*Pharmacology.*—The extract of liquorice largely covers the unpleasant taste of the aloes, and this preparation has consequently a purer bitter action than the other preparations of aloes. This is useful in



some conditions, such as atonic dyspepsia with constipation, although in these liquid extract of cascara sagrada is commonly preferred. Its action is otherwise the same as that of aloes.

**Decoctum Aloes Compositum.**—An aqueous solution containing 1 per cent. of extract of Barbados aloes and flavoured with aromatic substances and liquorice.

Extract of Barbados aloes,  $\frac{1}{2}$  oz. ; myrrh,  $\frac{1}{4}$  oz. ; saffron,  $\frac{1}{4}$  oz. ; potassium carbonate,  $\frac{1}{4}$  oz. ; extract of liquorice, 2 oz. ; compound tincture of cardamoms, 15 fl. oz. ; distilled water, to make 50 fl. oz.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

*Pharmacology.*—Its action is mainly that of aloes ; the dissolved portion of the myrrh, the cardamoms, &c., act chiefly as carminatives. It has been largely used in the treatment of amenorrhœa, but it often fails to relieve this condition. It acts by producing some degree of pelvic congestion, an effect which is secondary to its stimulant action on the lower part of the large intestine.

**Extractum Colocynthis Compositum.**—See page 388.

**Pilula Aloes Barbadosis.**—Contains approximately half its weight of Barbados aloes and a small quantity of oil of caraway.

Barbados aloes, 2 oz. ; hard soap, 1 oz. ; oil of caraway, 1 fl. dr. ; confection of roses, 1 oz., or a sufficiency.

*Dose.*—4 to 8 grains.

*Pharmacology.*—The oil of caraway acts as a carminative, and prevents the griping action of the aloes. The hard soap and confection of roses are mainly excipients.

**Pilula Aloes et Ferri.**—Contains Barbados aloes 2, exsiccated ferrous sulphate 1, compound powder of cinnamon 3, syrup of glucose 3.

*Dose.*—4 to 8 grains.

*Pharmacology.*—The sulphate of iron appears to increase the purgative action of the aloes. It is also absorbed to some extent. The compound cinnamon powder acts mainly as a carminative; the syrup of glucose is an excipient. This pill is very useful in the treatment of constipation in anæmic patients.

**Pilula Cambogiæ Composita.**—See page 529.

**Pilula Colocynthis Composita.**—See page 389.

**Pilula Colocynthis et Hyoscyami.**—See page 389.

**Aloe Socotrina.**—Includes Socotrine and Zanzibar aloes. ‘The juice that flows from the transversely cut leaves of Aloe Perryi, *Baker*, and probably other species of Aloe, evaporated to dryness.’

*Characters.*—Socotrine aloes occurs in hard, dark-brown masses, having a dull, uneven, resinous fracture, a characteristic odour (less unpleasant than that of Barbados aloes), and a bitter, nauseous taste. (When imported it is yellowish-brown and viscid.)

Zanzibar aloes occurs in liver-brown masses, with a dull, conchoidal fracture.

About half of both varieties is soluble in water. They are almost entirely soluble in 60 per cent. alcohol.

Both varieties, when examined under the microscope, show crystals embedded in a transparent matrix. With nitric acid they give a reddish or yellowish-brown colour.

*Chief Constituents.*—**Socaloin** or **Zanaloin**. The other constituents are similar to those of Barbados aloes.

*Dose.*—2 to 5 grains.

*Pharmacology.*—Its action is similar to that of Barbados aloes. It is somewhat less powerful and less unpleasant to the taste.

**Pilula Aloes Socotrinæ.**—Contains approximately half its weight of Socotrine aloes and a little oil of nutmeg.

Socotrine aloes, 2 oz. ; hard soap, 1 oz. ; oil of nutmeg, 1 fl. dr. confection of roses, 1 oz., or a sufficient quantity.

*Dose.*—4 to 8 grains.

*Pharmacology.*—The oil of nutmeg acts as a carminative ; the soap and confection of roses are mainly excipients.

**Pilula Aloes et Asafetidæ.**—Contains a quarter of its weight of Socotrine aloes and of asafetida.

Socotrine aloes, 1 ; asafetida, 1 ; hard soap, 1 ; confection of roses, 1, or a sufficiency.

*Dose.*—4 to 8 grains.

*Pharmacology.*—The asafetida acts mainly as a carminative. The pill is useful when a mild purgative action is required in cases where there is much flatulence.

**Pilula Aloes et Myrrhæ.**—Consists of Socotrine aloes 2, myrrh 1, syrup of glucose  $1\frac{1}{2}$  or a sufficiency.

*Dose.*—4 to 8 grains.

*Pharmacology.*—It is frequently given in amenorrhœa. The myrrh is believed to exert an action on the uterus, but it probably acts only as a carminative. The aloes produces slight pelvic congestion as a result of its stimulant action on the large intestine.

**Pilula Rhei Composita.**—See page 398.

**Tinctura Benzoini Composita.**—See page 531.

**Aloinum.**—Aloin obtained from any variety of official aloes. It may therefore be barbaloin, socaloin, or zanaloin, but is generally barbaloin.

It is obtained by extracting aloes with alcohol and purifying by recrystallisation. It is generally prepared from Curaçao aloes.

*Characters.*—A yellow crystalline or amorphous powder, without odour, but with a bitter, unpleasant taste. Soluble in about 120 parts of water and in 20 parts of alcohol, but

nearly insoluble in ether. It dissolves in caustic alkali solutions with the formation of a reddish-brown colour.

*Dose.*— $\frac{1}{2}$  to 2 grains.

*Pharmacology.*—It is a somewhat more powerful, but sometimes a less certain, purgative than aloes. It is probably more liable to be absorbed. It is used for the same purposes as aloes, and is always administered in the form of pills.



## DRUGS WHICH OWE THEIR ACTIVITY TO TANNIC ACID

TANNIN is a common constituent of plants, and therefore of vegetable drugs (see page 16). In many cases its presence is a disadvantage, but in a few it is so abundant as to become the active principle of the drug. These drugs consequently exert a very similar action, and it is often immaterial which of them is employed in therapeutics.

*Pharmacological Action of Tannic Acid.*—This substance precipitates albuminous solutions,<sup>1</sup> and therefore acts as an astringent. It has no effect on the intact skin, but applied to denuded surfaces it constricts the tissues, stops bleeding, and produces transient smarting pain.

Taken by the mouth, it has a powerful astringent taste, produces an astringent effect on the throat, and, if no food is present, a similar effect on the mucous membrane of the stomach. If food is present, the astringent action is less marked, because most of the tannin combines with the albumens of the gastric contents. It is, however, again set free during digestion. It exerts a similar astringent action on the intestinal mucous membrane, and thereby induces constipation, the stools passed being small, hard, and dry.

During its passage down the alimentary canal ordinary tannic acid (gallo-tannic acid) is converted largely into gallic acid, and is absorbed as sodium gallate. A small portion is absorbed as sodium tannate. A very small portion is excreted in the fæces as gallic acid, and, to a less extent, as tannic acid. Of the sodium gallate and tannate absorbed, only a

<sup>1</sup> The precipitate is soluble in excess of the solution, and in solutions of alkalis and certain acids.

small amount appears in the urine. What becomes of the rest is unknown; it is believed to be oxidised in the body. No distinct general symptoms are produced. By some physicians tannic and gallic acids are believed to act as mild astringents on the kidney, but there is not much experimental evidence in favour of this view, although recently it has been maintained that sodium tannate still retains an astringent action. Gallic acid is very slightly astringent.

After a pharmacopœial dose (2 to 5 grains) of tannic acid, no effect beyond a slight astringent action on the alimentary tract is produced. After large doses (30 to 40 grains) the stomach is irritated; pain and vomiting, and even diarrhœa, may occur. Continued use of small doses of tannin leads to indigestion.

The tannic acid occurring in crude drugs is in most cases associated with colloidal matter, and mainly on this account is less liable to be absorbed. Consequently these drugs are more useful intestinal astringents than tannic acid itself.

Tannic acid is employed to stop hæmorrhage in accessible situations; to diminish the discharge from weeping surfaces and chronically inflamed mucous membranes and stimulate healthy healing; and as an intestinal astringent in diarrhœa. For the last-named purpose the tannin-containing drugs are most commonly employed, and are usually combined with other remedies (opium, chalk, &c.). Tannic acid is occasionally given for hæmorrhage from the kidneys, and it is sometimes administered in cases of alkaloid poisoning to form an insoluble tannate previously to emptying the stomach.

#### TANNIC ACID

**Acidum Tannicum.**—Tannin.  $C_{14}H_{10}O_9$ . Probably the anhydride of di-gallic acid (*i.e.* a condensation product of two molecules of gallic acid). This view, however, has recently been questioned.

Prepared by extracting powdered galls with ether containing a little water and alcohol, and purifying and crystallising the syrupy aqueous layer.

*Characters.*—A pale, buff-coloured, amorphous substance occurring in thin, glistening scales, with a slight characteristic odour and a strongly astringent taste. Soluble in less than its weight of water or alcohol and slowly in 1 part of glycerin.

It gives with solutions of ferric salts a bluish black colour (ink). Its aqueous solutions precipitate solutions of albumen or gelatine. It also precipitates most alkaloidal solutions and solutions of salts of the heavy metals, forming insoluble tannates. A solution of tartarated antimony is precipitated by it.

After incineration it should leave no appreciable amount of ash.

*Dose.*—2 to 5 grains.

**Glycerinum Acidi Tannici.**—Contains 1 ounce of tannic acid in 5 fluid ounces.

Tannic acid, 1 oz.; glycerin, sufficient to produce 5 fl. oz.

*Pharmacology.*—A useful astringent preparation to paint on subacute or chronic pharyngitis, sore nipples, &c.

**Suppositoria Acidi Tannici.**—Each suppository contains 3 grains of tannic acid.

*Pharmacology.*—Used as an astringent application for hæmorrhoids, anal fissure, and chronic irritable conditions of the lower part of the rectum.

**Trochiscus Acidi Tannici.**—Each lozenge contains  $\frac{1}{2}$  grain of tannic acid. Fruit basis.

*Pharmacology.*—Useful for relaxed throat and similar conditions.

#### GALLIC ACID

**Acidum Gallicum.** — ‘A trihydroxybenzoic acid,  $C_6H_2(OH)_3COOH, H_2O$ .’

Prepared by hydrolysing tannic acid by means of dilute sulphuric acid.

*Characters.*—Cream-coloured acicular crystals, without odour, but with a faintly acid taste. Soluble in 100 parts of

water, in 5 parts of alcohol, in 50 parts of ether, and in 12 parts of glycerin.

It should not contain sulphates, tannic acid, or mineral matter. It differs from tannic acid in that its solutions do not precipitate solutions of gelatine, albumen, or alkaloidal salts. The Pharmacopœia says that it does not precipitate solutions of tartarated antimony, but this is a mistake. It gives with solutions of iron salts a bluish-black precipitate.

*Dose*.—5 to 15 grains.

*Pharmacology*.—It possesses no action of importance. It was believed to exert a remote astringent effect on the kidney and other organs, and was therefore administered in hæmaturia, albuminuria, &c., but it is comparatively rarely used now.

## GALLS

**Galla**—Aleppo or Turkey Galls. ‘Excrescences on *Quercus infectoria*, *Olivier*, resulting from the puncture and deposition of an egg or eggs of *Cynips Gallæ tinctoriæ*, *Olivier*.’

*Characters*.—Nearly globular in shape but tuberculated, hard, heavy, dark bluish-green or olive-green in colour, and from  $\frac{1}{2}$  to  $\frac{3}{4}$  inch in diameter. Both the tubercles and the

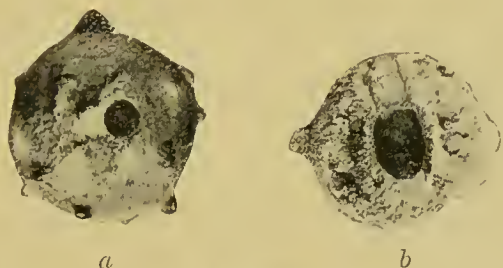


FIG. 60.

Galls. The figure illustrates the so-called ‘white’ galls (galls from which the gall-wasp has escaped). (a) Gall showing external opening through which the gall-wasp has escaped. (b) Section showing cavity and channel of exit. Natural size.

intervening spaces are smooth. Interiorly the gall is cream or light-buff coloured. The section shows a central cavity containing the remains of the larva or gall-wasp. Without odour but having a strongly astringent taste.

The pharmacopœial description applies to the so-called ‘blue’ or ‘green’ galls, which still retain the gall-wasp. After this has bored its



way out, the galls become yellowish-brown in colour ('white' galls) and inferior in quality.

*Chief Constituents.*—**Tannic acid** (50 to 70 per cent.).  
**Gallie acid** (2 to 4 per cent.).

**Unguentum Gallæ.**—Consists of galls 1; benzoated lard 4.

*Pharmacology.*—An astringent ointment, useful in hæmorrhoids.

**Unguentum Gallæ cum Opio.**—Consists of gall ointment 12½; opium 1.

*Pharmacology.*—Largely used for hæmorrhoids. It is commonly known as 'pile ointment.'

## CATECHU

**Catechu.**—'An extract of the leaves and young shoots of *Uncaria Gambier*, Roxb.'

*Characters.*—Reddish-brown cubes, about 1 inch in diameter, separate or more or less agglutinated. The section is granular and cinnamon-brown in colour. It is almost entirely soluble in boiling water. It has no odour; the taste is bitter and strongly astringent with a sweetish after-taste.



FIG. 61.

Catechu. Natural size.

At least 70 per cent. should be soluble in 90 per cent. alcohol. It should contain no starch and should not yield more than 5 per cent. of ash. Microscopically examined, it is seen to consist mainly of minute acicular crystals.

The official catechu is known as pale catechu, to distinguish it from black catechu or cutch, which is official in the Addendum (see page 593) and in most foreign Pharmacopœias.

*Chief Constituents.*—**Catechu-tannic acid** (30 to 50 per cent.); **catechin** (10 to 20 per cent.).

Catechin occurs in white, silky, acicular crystals, with an astringent taste, sparingly soluble in cold, but readily in hot water. On treatment with dehydrating agents it loses a molecule of water, and is converted into catechu-tannic acid. This is a reddish amorphous substance, readily soluble in water and alcohol. On boiling with water or dilute acids it is converted into catechu-red.

Catechu also contains catechu-red, quercetin, a fluorescent substance, gum, and unimportant ingredients.

**Tinctura Catechu.**—Contains the active ingredients of 1 ounce of catechu and  $\frac{1}{4}$  ounce of cinnamon bark in 5 fluid ounces.

Catechu, 4 oz.; cinnamon bark, 1 oz.; alcohol (60 per cent.), 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—The cinnamon is added as a flavouring agent, but on account of the tannin it contains it also aids the astringent action of the catechu. The preparation is used largely in the treatment of diarrhœa.

**Pulvis Catechu Compositus.**—Consists of catechu 4; kino 2; krameria root 2; cinnamon bark 1; nutmeg 1.

*Dose.*—10 to 40 grains.

*Pharmacology.*—It consists almost solely of vegetable astringents, and consequently has a powerful intestinal astringent action. The cinnamon bark and nutmeg are carminative. It is used in the treatment of diarrhœa.

**Trochiscus Catechu.**—Each lozenge contains 1 grain of catechu. Simple basis.

*Pharmacology.*—A useful astringent lozenge for relaxed throat.

## KINO

**Kino.**—‘The juice obtained from incisions in the trunk of the *Pterocarpus Marsupium*, *Roxb.*, evaporated to dryness.’

*Characters.*—Small angular shining pieces, reddish-black and opaque, but, when seen in thin laminæ, ruby-red and transparent. It has a strongly astringent taste and no odour. When chewed, it tinges the saliva red. It is brittle, but

does not tend to form powder by natural attrition. The greater part is soluble in water; it is almost entirely soluble in alcohol, but insoluble in ether.

At least 80 per cent. should be soluble in boiling water.  
Compare with Eucalyptus Gum (see below).

*Active Principle.*—**Kino-tannic acid** (50 to 80 per cent.).

It also contains a colourless crystalline substance, kinoin (1·5 per cent.), and kino-red, pyrocatechin, and gallic acid in small quantities.

Kino-tannic acid, when boiled with dilute mineral acids, and kinoin on heating, are converted into kino-red.

*Dose.*—5 to 20 grains.

**Tinctura Kino.**—Contains 1 ounce of kino in 10 fluid ounces.

Kino, 2 oz.; glycerin, 3 fl. oz.; distilled water, 5 fl. oz.; alcohol (90 per cent.), to make 20 fl. oz.

The glycerin is believed to retard the gelatinisation to which this tincture is liable.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action and uses are similar to those of tincture of catechu.

**Pulvis Kino Compositus.**—Consists of kino 15; opium 1; cinnamon bark 4.

*Dose.*—5 to 20 grains.

*Pharmacology.*—It is a very useful astringent powder for diarrhoea due to various causes. The opium aids the constipating action of the kino and relieves pain and irritation if present. The cinnamon bark also acts as an auxiliary agent and flavouring ingredient.

**Pulvis Catechu Compositus** (see page 417).

#### EUCALYPTUS GUM

**Eucalypti Gummi.**—‘A ruby-coloured exudation, or so-called red gum, from the bark of *Eucalyptus rostrata*, *Schlecht.*, and some other species of *Eucalyptus*. Imported from Australia.’

*Characters.*—Somewhat lighter in colour and tougher, but otherwise similar to kino. It usually presents a dusty appearance owing to the presence of powder, partly if not wholly formed by natural attrition. This character is of some importance in distinguishing it from kino. About 90 per cent. of a good specimen is soluble in water ; almost entirely soluble in alcohol.

*Active Principle.*—**Kino-tannic acid** (40 to 50 per cent.).

It also contains kino-red, catechin, pyrocatechin, gum, and other unimportant substances.

*Dose.*—2 to 5 grains.

*Pharmacology.*—Its action is similar to but somewhat weaker than that of kino, and it is also believed to be somewhat more prolonged owing to the greater quantity of colloidal matter present. It may be used for the same purpose as kino, and must be given in similar doses—the reason for the small official dose is not obvious. Eucalyptus gum is also employed in the form of a lotion or injection for discharging mucous surfaces, and as a styptic.

**Trochiscus Eucalypti Gummi.**—Each lozenge contains 1 grain of eucalyptus gum. Fruit basis.

*Pharmacology.*—It is a useful astringent lozenge for relaxed throat, sore mouth, &c.

#### RHATANY ROOT

**Krameria Radix.** — ‘The dried root of (1) Para Rhatany, a species of *Krameria*, attributed to *Krameria argentea*, *Mart.* ; or of (2) Peruvian Rhatany, *Krameria triandra*, *Ruiz and Pavon.*’

*Characters.*—(1) Para rhatany. Long, nearly cylindrical and straight pieces, purplish-brown in colour, slightly wrinkled longitudinally, and marked at irregular intervals by deep transverse cracks, but otherwise smooth. The fracture is short ; the fractured surface shows a thick dark reddish-brown bark (about  $\frac{1}{4}$  the diameter of the root in thickness),



and a pale reddish-brown wood. The bark is firmly adherent to the wood. It has no distinct odour, but the bark has a



FIG. 62.

Para Rhatany, showing transverse cracks and appearance of section. The lower piece shows portions of the central woody axis from which the bark has been removed. Natural size.

strongly astringent taste, and when chewed colours the saliva red.

Compare with Hemidesmus root (page 380).

(2.) Peruvian rhatany. The variety most commonly seen in commerce. Reddish-brown in colour, and in the larger pieces, rough and scaly. The fracture is splintery. The section



FIG. 63.

Peruvian Rhatany. The lower piece shows appearance of the section; the bark is relatively thinner, as compared with the wood, than in the Para variety. Natural size.

shows a reddish-brown bark (about  $\frac{1}{8}$  the diameter of the root in thickness) and a pale reddish-brown wood. The odour and taste are the same as those of Para rhatany.

The two varieties are easily distinguished. The dark purplish-brown relatively thick adherent bark with deep transverse cracks being characteristic of Para rhatany; the reddish-brown bark, easily separable, showing no deep transverse fissures, but scaly in the larger pieces and relatively thin as compared with the wood, being characteristic of Peruvian rhatany.

*Active Principle.*—**Krameria-tannic** (or rhatanhia-tannic) acid (8 to 9 per cent.).

The colouring matter, a decomposition product of the tannin, is rhatanhia-red. An amido-acid, rathanhin, has been isolated, but is of no pharmacological importance.

*Pharmacology.*—It is a weaker astringent than the preceding substances, but its action is otherwise the same.

**Extractum Krameriaë.**—An aqueous extract of dry consistence.

*Dose.*—5 to 15 grains.

**Trochiscus Krameriaë.**—Each lozenge contains 1 grain of extract of krameria. Fruit basis.

*Pharmacology.*—A useful lozenge for relaxed conditions of the throat. It has a somewhat unpleasant taste.

**Trochiscus Krameriaë et Cocainæ.** — Each lozenge contains 1 grain of extract of krameria, and  $\frac{1}{20}$  grain of cocaine hydrochloride. Fruit basis.

*Pharmacology.*—The cocaine relieves irritation, and this lozenge is therefore better than the simple lozenge when much irritation is present.

**Infusum Krameriaë.**—Contains the active ingredients of 1 ounce of krameria root in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—It may be administered internally for diarrhœa or may be used as a gargle for relaxed throat, or even as a lotion or injection for discharging mucous surfaces. The infusion is liable to deposit by keeping.

**Liquor Krameriaë Concentratus.** — Contains the active principles of 1 ounce of krameria root in 2 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Krameriaë.**—Contains the active principles of 1 ounce of krameria root in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is similar to, but weaker than, that of tincture of catechu. It is used chiefly as an intestinal astringent.

**Pulvis Catechu Compositus** (see page 417).

## LOGWOOD

**Hæmatoxyli Lignum.**—‘The heart-wood of *Hæmatoxylon campechianum*, *Linn.*’

*Characters.*—It is imported in large logs and may therefore be seen in pieces of various sizes and shapes, or in chips or turnings or coarse powder. The wood is dark orange or purplish-red externally and reddish-brown internally, hard

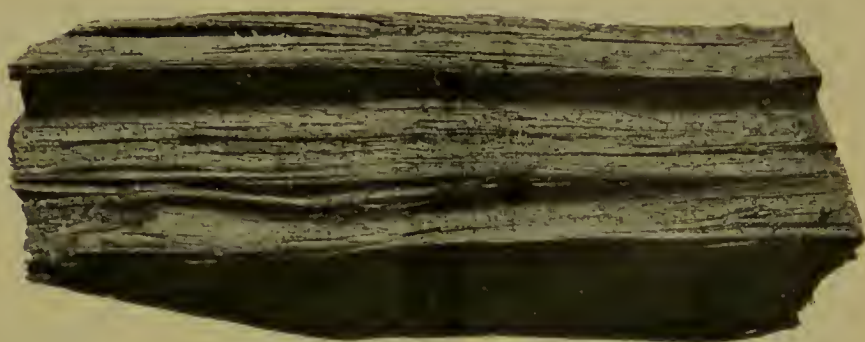


FIG. 64.

A piece of logwood.  $\frac{4}{5}$  linear.

and heavy, but easily split. The chips and powder should be reddish-brown in colour and should have a slight but pleasant odour and a sweetish astringent taste, *i.e.* they should be unfermented (see below). When chewed, it colours the saliva a reddish-purple.

Compare with Red Sanders Wood (page 570), which is redder, has less astringent taste, and does not colour the saliva so markedly when chewed.

*Chief Constituents.*—**Tannin**; **Hæmatoxylin** (about 10 per cent.).

It also contains a trace of volatile oil, resin, &c.

Hæmatoxylin when oxidised forms hæmatein, which is largely employed as a dye. To obtain this the chips or raspings are moistened and exposed to the air for four to six weeks. They then assume a darker colour, and show patches of dark-green lustre. The wood in this condition is not official. Hæmatoxylin has a sweetish taste; hæmatein is bitter, acrid, and somewhat astringent.

**Decoctum Hæmatoxyli.**—Contains the active ingredients of 1 ounce of logwood and a little cinnamon bark in 20 fluid ounces.

Logwood, 1 oz.; cinnamon bark, 70 gr.; distilled water, to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

*Pharmacology.*—It is a mild astringent preparation, useful in diarrhœa due to various causes. It has been employed as an injection and lotion for conditions in which astringent applications are useful.

#### HAMAMELIS OR WITCH HAZEL

The fresh and dried leaves and the bark of the plant are official.

**Hamamelidis Cortex.**—‘The dried bark of *Hamamelis virginiana*, *Linn.*’

*Characters.*—Channelled pieces up to 8 inches in length and 1 inch in breadth, and about  $\frac{1}{16}$  inch in thickness. The

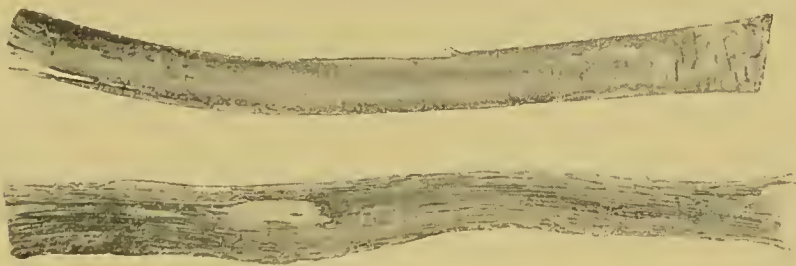


FIG. 65.

Hamamelis bark, showing external and internal surface.  $\frac{1}{2}$  linear.

outer surface is smooth, pale brownish-pink in colour, but sometimes covered with a smooth ash-grey or a scaly dark-grey cork showing transverse lenticels. The inner surface is



pale reddish-pink in colour, finely striated longitudinally, and sometimes showing patches of adhering white wood. The fracture is coarsely fibrous. It has no distinctive odour; the taste is astringent.

*Chief Constituent.*—**Tannin** (about 6 per cent.).

The tannic acid occurs in a crystalline (hamamelotannin) and a glucosidal amorphous form. There are also present gallic acid, resin, volatile oil, bitter and pungent principles in small quantity.

*Pharmacology.*—Its action is probably due merely to the tannin which it contains, but the question cannot be regarded as settled.

**Tinctura Hamamelidis.**—Contains the active principles of 1 ounce of hamamelis bark in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is a useful astringent and styptic, and is attributed with a hæmostatic action after absorption, but this effect is doubtful. It is used, diluted with water, as a local application for bleeding piles and other bleeding surfaces, and as an astringent wash for discharging mucous membranes, and is given internally for menorrhagia and other hæmorrhagic conditions.

**Hamamelidis Folia.**—‘The leaves, fresh and dried, of *Hamamelis virginiana*, *Linn.*’

*Characters.*—Broadly ovate, tapering obliquely towards the base which is usually cordate, with an obtuse apex, a sinuate margin, and a short petiole; varying in size up to 6 inches in length and 4 inches in breadth. The upper surface is dark green or brownish green in colour; the under surface is paler. The veins arise pinnately from the midrib and run straight to the sinuations on the margin; they are prominent on the under surface and, in young leaves, are hairy. The leaves are usually very broken in appearance. The odour is slight, the taste is astringent and slightly bitter.

*Chief Constituent.*—**Tannin.**

Gallic acid, a bitter principle, and a trace of volatile oil also occur.

Prepared from the **fresh** leaves.



FIG. 66.

Dried hamamelis leaf. Natural size.

**Liquor Hamamelidis.**—A weak alcoholic solution of volatile substances obtained from fresh hamamelis leaves.

Prepared by macerating 50 oz. of fresh hamamelis leaves in 100 fl. oz. of water and 10 fl. oz. of alcohol (90 per cent.) for twenty-four hours, and then distilling one-half.

Its constituents are not completely known. It contains a little volatile oil and a little protocatechuic acid. Some decomposition apparently goes on in the still.

*Pharmacology.*—Its action is similar to that of diluted alcohol containing a little volatile oil. It is used as a styptic and astringent, but its action as such is very mild. Prepared from the dried leaves.

**Extractum Hamamelidis Liquidum.**—Contains the active ingredients of 1 ounce of hamamelis leaves in 1 fluid ounce.

*Dose.*—5 to 15 minims.

*Pharmacology.*—It is an astringent and local hæmostatic. It is often given for a remote hæmostatic effect, but it is questionable if it possesses such an action.

**Unguentum Hamamelidis.**—Consists of liquid extract of hamamelis 1 ; hydrous wool fat 9.

*Pharmacology.*—It is an astringent ointment, used mainly for piles.

## DRUGS CONTAINING ACTIVE NEUTRAL PRINCIPLES

IN this group are included a number of drugs containing active principles regarding the chemistry of which little is known. They may be divided into (i) drugs containing pure bitter principles; (ii) drugs containing active principles which cannot, at present, be conveniently classified. The latter will be taken first.

### CANTHARIDES

**Cantharis.**—‘The dried beetle *Cantharis vesicatoria*, *Latr.*’



FIG. 67.

Cantharis, showing upper and under surfaces. The dried beetle is rarely found perfect. Natural size.

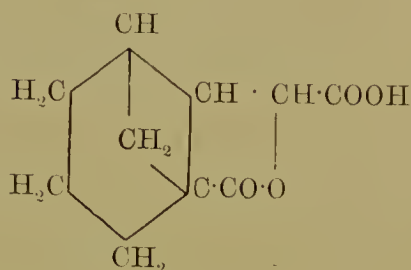
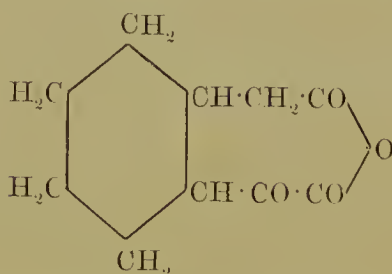
*Characters.*—The most obvious character is the iridescent bright-green wing-sheaths. The beetles are about  $\frac{3}{4}$  to 1 inch long and  $\frac{1}{4}$  inch broad. They have a strong unpleasant odour.

Their general characters are similar to those of other beetles; they have the special characters (head with an abrupt neck, &c.) belonging to the family Cantharidæ.



*Active Principle.*—**Cantharidin** (0·5 to 1 per cent.).

Cantharidin,  $C_{10}H_{12}O_4$ , is a colourless crystalline substance, insoluble in water, but soluble in chloroform, ether, acetic ether, &c., and sparingly in alcohol and in fats and oils. Acetone is the best solvent. It is the anhydride of cantharidic acid, some salts of which, but not the acid, are known. The following formulæ have been proposed for it:



The beetles contain 12 per cent. of a fixed oil.

*Pharmacology.*—Its action is due to the cantharidin it contains. This substance is a powerful irritant. When applied to the skin it slowly produces redness and burning pain, followed by the formation of vesicles which coalesce to form a blister. If taken by the mouth in considerable doses it produces symptoms of irritant poisoning, and after absorption causes marked irritation of the kidneys and the urinary tract. The beetle is used only in the form of its preparations, and these are employed almost solely for their local effects. Three are employed as blisters, three for their rubefacient action, and one may be given internally.

**Emplastrum Cantharidis.**—Contains approximately 1 of cantharides in 3.

Cantharides,  $3\frac{1}{2}$  oz.; yellow beeswax, 2 oz.; lard, 2 oz.; resin, 2 oz.; soap plaster,  $\frac{1}{2}$  oz.

*Characters.*—The mass is of a soft clayey consistence, and has a dark greenish-brown colour interspersed with bright-green specks. The odour is characteristic.

*Pharmacology.*—When applied to the skin no symptoms appear for 2 to 4 hours, then redness with more or less burning pain occurs; vesicles subsequently form and these coalesce and produce a blister which is usually fully formed after 8 to 10 hours. The application of hot

fomentations or a poultice when well-marked redness has been produced (after 4 to 6 hours) will generally raise a blister.

Blistering is resorted to mainly to relieve deep-seated pain, and is often followed by beneficial results. It should not be employed in renal disease, because absorption of cantharidin occurs from the blister, sometimes in sufficient amount to produce irritation of the kidneys. It is also inadvisable to employ it over paralysed areas, in children, and in old and debilitated persons.

**Liquor Epispasticus.**—Blistering liquid. Contains the active principle of 1 ounce of cantharides in 2 fluid ounces of acetic ether.

*Pharmacology.*—Its action is practically the same as that of the emplastrum. It is used mainly to make blistering collodion.

**Collodium Vesicans.**—Blistering liquid containing a little pyroxylin.

Blistering liquid, 20 fl. oz.; pyroxylin,  $\frac{1}{2}$  oz.

*Pharmacology.*—When painted on the skin the acetic ether evaporates, leaving a thin pellicle containing cantharidin. Its action is similar to that of the emplastrum, but it is somewhat less certain and is consequently less frequently employed.

**Acetum Cantharidis.**—Contains the active principle of 1 ounce of cantharides in 10 fluid ounces of a mixture of equal parts of glacial acetic acid and distilled water.

*Pharmacology.*—It is strongly irritant, but is rarely used, except in a diluted form, as a lotion to stimulate the growth of hair. It may be employed to apply to very chronic ringworm.

**Unguentum Cantharidis.**—Contains approximately the active principle of 1 ounce of cantharides in 10 ounces of benzoated lard.

*Pharmacology*.—It slowly produces a rubefacient effect, and may be employed as a mild counter-irritant to relieve pain in joints and other deep-seated pains, and as a direct irritant to bald patches or to chronic ringworm. It is not much used.

**Emplastrum Calefaciens**.—Warming plaster. Contains approximately the water-soluble ingredients of 1 of cantharides in 25.

The basis is yellow beeswax, resin, resin plaster, and soap plaster.

*Pharmacology*.—It produces a slight rubefacient action, and may be employed when such is required.

**Tinctura Cantharidis**.—Contains the active principle of 1 ounce of cantharides in 80 fluid ounces.

*Dose*.—5 to 15 minims; if frequently repeated, 2 to 5 minims.

*Pharmacology*.—When taken in full pharmacopœial doses it stimulates the kidneys, increasing the amount of urine, and also often irritates the urinary tract. Thus pain and strangury are not uncommon after its use. It is of doubtful therapeutic value.

## CAPSICUM

**Capsici Fructus**.—‘The dried ripe fruit of *Capsicum minimum*, *Roeb.*’

*Characters*.—Conical fruits from  $\frac{1}{2}$  to  $\frac{3}{4}$  inch long, and about  $\frac{1}{4}$  inch broad, sometimes attached to a 5-toothed calyx and a slender straight peduncle. The pericarp is dull orange-red, translucent, leathery, and somewhat shrivelled. On section the fruit is seen to be divided into two cells by a longitudinal dissepiment; each cell containing 5 to 10 small yellowish flat seeds. The odour is characteristic; the taste,



FIG. 68.  
(a) Capsicum fruit. (b) Section showing dissepiment. (c) Seeds contained in fruit. (a) and (b)  $\frac{2}{3}$  linear; (c) natural size.

especially of the lower part of the dissepiment, is pungent and burning.

*Active Principle*.—**Capsaicin** (about 0·02 per cent.).

Capsaicin ( $C_9H_{11}O_2$ ) is a crystalline substance which may be volatilised with care. It is present in largest amount in the dissepiment.

Capsicum also contains two alkaloids, an un-named volatile alkaloid and a crystalline alkaloid, capsicine. It also yields small quantities of a volatile oil, resin, &c.

*Pharmacology*.—When rubbed into the skin it produces burning pain and a rubefacient effect. It has a powerful pungent taste. Small doses act as a carminative in the stomach and intestines; moderate doses stimulate and large doses irritate the gastric mucous membrane. It is used mainly as a condiment, but may be given combined with other substances as a stimulant and carminative in the form of pills.

**Tinctura Capsici**.—Contains the active principle of 1 ounce of capsicum in 20 fluid ounces.

*Dose*.—5 to 15 minims.

*Pharmacology*.—It produces a mild rubefacient effect when rubbed into the skin. It is sometimes applied to unbroken chilblains, and, diluted, as a lotion to promote the growth of hair. Taken by the mouth it has a hot burning taste and produces a feeling of warmth in the stomach. It is given to drunkards to allay the craving for alcohol, and is sometimes used, diluted with water, as a gargle for relaxed throat.

**Unguentum Capsici**.—Contains approximately the active principle of 1 of capsicum in  $4\frac{1}{2}$  of ointment.

Capsicum fruit, 12; spermaceti, 6; olive oil, 44.

*Pharmacology*.—It produces a rubefacient action, and is used mainly as a counter-irritant for chronic rheumatic joints.

## GINGER

**Zingiber**.—‘The scraped and dried rhizome of *Zingiber officinale*, *Roscoe*.’



*Characters.*—Irregularly branched, flattish pieces, fibrous and striated externally, of a pale buff colour. Each branch terminates in a depressed scar. The fracture is short and somewhat fibrous, and the fractured surface shows a fine

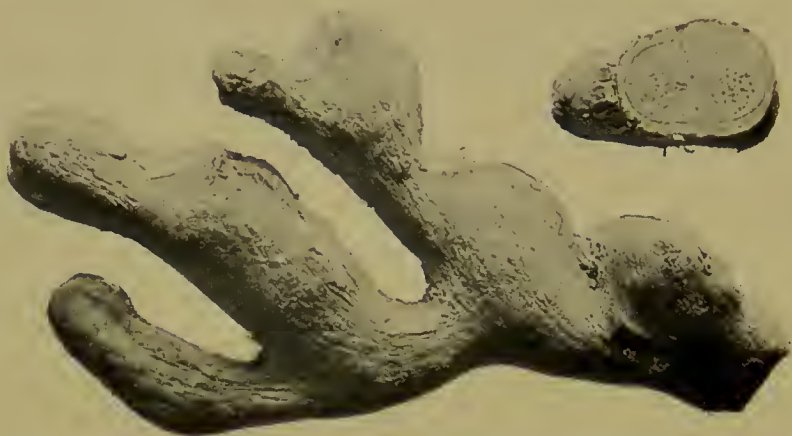


FIG. 69.

Ginger, and section showing the peripheral yellow line and oil glands.  
Natural size.

yellow line (cambium) near the periphery, and numerous yellow oil glands. The odour is characteristic, the taste is hot and pungent.

*Chief Constituents.*—**Gingerol**, a yellowish oily body, without odour, but with a very pungent taste. A **volatile oil** (2 to 3 per cent.) to which the odour is due. Resinous matter.

The volatile oil consists mainly of a sesqui-terpene, but contains also *d*-camphene and phellandrene. Little is known of the chemistry of gingerol. It is soluble in alcohol, ether, and oils.

Gingerine is a mixture of the active principles of the drug. It is obtained by percolation with ether.

*Pharmacology.*—Its action is similar to that of capsicum, but weaker. In the stomach and intestines it acts, in small doses, as a carminative, and it is used mainly as a carminative and flavouring agent. For these purposes it is present in many official preparations.

**Syrupus Zingiberis.**—Contains the active ingredients of 1 ounce of ginger in 40 fluid ounces. See page 39.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Zingiberis.**—Contains the active principles of 1 ounce of ginger in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

Ginger is an ingredient of Pulvis Jalapæ Compositus, Pulvis Rhei Compositus, Pulvis Scammonii Compositus, Pulvis Opii Compositus, Pulvis Cinnamomi Compositus (and, therefore, of Pilula Aloes et Ferri and Pilula Cambogiæ Composita), Infusum Sennæ (and, therefore, of Mistura Sennæ Composita). Tincture of ginger is used in preparing Acidum Sulphuricum Aromaticum (and, therefore, Infusum Cinchonæ Acidum), Liquor Sennæ Concentratus, and Pilula Scammonii Composita.

#### ARNICA RHIZOME

**Arnica Rhizoma.**—‘The dried rhizome and roots of *Arnica montana*, *Linn.*’

*Characters.*—Cylindrical, somewhat curved, dark-brown rhizome, usually from 1 to 2 inches long, and  $\frac{1}{6}$  to  $\frac{1}{4}$  inch thick, marked on the upper surface with encircling scars, and giving off from the under surface numerous brittle wiry roots. It is frequently branched. The transverse section, under a lens, shows a ring of resin ducts near the wood. It has a faintly aromatic odour, and a bitter acrid taste.

*Chief Constituents.*—**Arnicin** ( $C_{12}H_{22}O_2$ ), a yellow crystalline substance with an acrid taste. A **volatile oil** (about 0·5 per cent.). Tannin.



FIG. 70.

Arnica rhizome, with remains of stem attached. Natural size.

**Tinctura Arnicae.**—Contains the active ingredients of 1 ounce of arnica rhizome in 20 fluid ounces.

*Pharmacology.*—It is somewhat irritant. Repeatedly applied, it may produce severe inflammation. It is used to paint on chilblains, and, diluted with water, to apply to bruises.

## MEZEREÓN BARK

**Mezerei Cortex.**—‘The dried bark of *Daphne Mezereum*, *Linn.*, or of *Daphne Laureola*, *Linn.*, or of *Daphne Gnidium*, *Linn.*’

*Characters.*—Long, thin flattened strips or quills, flexible and very tough. It separates easily into a thin brownish



FIG. 71.

Mezereon bark: (a) external surface, showing thin easily separable bark; (b) internal surface, showing silky striated appearance. Natural size.

(varying from olive or reddish brown to dark purplish brown) outer layer, and a nearly white, silky, fibrous inner layer. It has no distinctive odour, but has an acrid burning taste.

*Chief Constituents.*—**Mezerein**, an acrid resinous substance, easily converted into a bitter acrid resinous acid, mezeric acid. **Daphnin**, a crystalline bitter glucoside.

*Pharmacology.*—It is a decided irritant. If the bark is moistened and applied to the skin it produces redness, the

formation of vesicles, and even blisters. Taken internally in large doses, it produces irritant poisoning. It is of doubtful therapeutic value, and is only introduced into the Pharmacopœia to put into the following preparation.

**Liquor Sarsæ Compositus Concentratus.** See page 379.

PODOPHYLLUM RHIZOME

**Podophylli Rhizoma.**—‘The dried rhizome and roots of *Podophyllum peltatum*, *Linn.*’

*Characters.*—The rhizome is nearly straight and cylindrical,  $\frac{1}{5}$  to  $\frac{1}{3}$  inch in diameter, and marked at intervals of

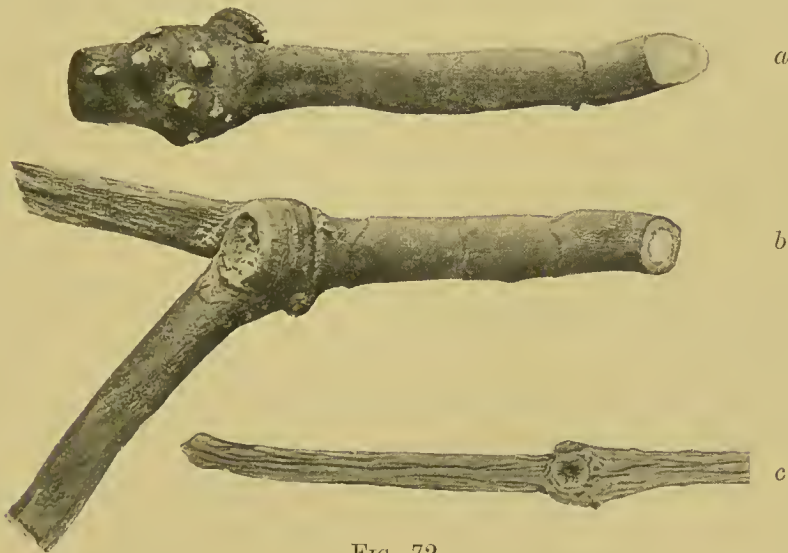


FIG. 72.

Podophyllum rhizome: (a) under surface, showing scars of roots; (b) upper surface, showing depressed circular scar; (c) an inferior quality of rhizome. Natural size.

about 2 inches by enlargements, which show a depressed circular scar above and the remains of stout brittle roots below. The bark is nearly smooth, and of a dark reddish-brown colour. The fracture is short. The transverse section shows a thin cortex and a ring of fibro-vascular bundles interiorly; it is white and starchy, or if the heat employed to dry the rhizome has been excessive, yellowish-brown and



horny. The odour is slight and characteristic; the taste is somewhat bitter and acrid.

The rhizome is occasionally branched. Poor qualities are shrivelled and longitudinally wrinkled.

*Chief Constituent.*—The official resin (4 to 6 per cent.) which consists of a crystalline neutral principle, **Podophyllo-toxin**, an uncrystallisable resinous substance, **Podophyllo-resin**, a small amount of fatty matter, and a crystalline colouring substance, quercetin.

Podophyllotoxin,  $C_{15}H_{14}O_6$ , when heated with alkalis is converted into a salt of podophyllic acid. The acid is unstable, loses water, and forms the anhydride, picropodophyllin, which is isomeric with podophyllotoxin, but is much less active pharmacologically.

*Pharmacology.*—Podophyllotoxin is very irritating, but its action develops slowly. When given by the mouth it produces purgation, but apparently only when bile is present. It also produces purgation along with other symptoms when injected hypodermically or intravenously, but it is very doubtful if this action is specific. Podophyllo-resin is much less powerful.

**Podophylli Resina.**—The resinous principle obtained from podophyllum rhizome.

Prepared by exhausting the rhizome with alcohol, pouring into acidulated distilled water, washing and afterwards drying the precipitate at a low temperature.

*Characters.*—A yellow or yellowish brown amorphous powder, with a faint odour and a bitter, somewhat acrid, taste. Insoluble in water; the greater part is soluble in alcohol and in solution of ammonia.

It should not yield more than 1 per cent. of ash.

*Dose.*— $\frac{1}{4}$  to 1 grain.

*Pharmacology.*—It slowly produces an irritant effect if applied externally. When taken by the mouth in ordinary doses it seldom produces any effect until it reaches the intestines. Then it causes irritation and in about 10 to 12 hours a watery evacuation. Colic usually occurs.

Its most important action is exerted on the upper part of the small intestine, and bile appears to be necessary for its action. It is said to increase the secretion of bile, but this is probably erroneous.

It is used as a purgative in constipation associated with hepatic disorders, but, owing to its slow action and its tendency to produce colic, it is well to combine it with some other purgative and a carminative.

**Tinctura Podophylli.**—Contains 2 grains of podophillum resin in 1 fluid drachm.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action is that of the resin. It is an unnecessary preparation.

## ELATERIUM

**Elaterium.**—‘A sediment from the juice of the fruit of *Ecballium Elaterium*, *A. Richard*,’ the squirting cucumber. It should yield 25 per cent. (not less than 20 per cent.) of Elaterin.

The fruit resembles a small hairy gherkin. When ripe it suddenly and forcibly separates from the peduncle and ejects the seeds and juice. It is therefore collected before it is quite ripe, and is sliced and pressed. The expressed juice is allowed to stand and deposit, during which process it becomes still more turbid. The deposit is then drained and dried on tiles.



FIG. 73.

*Characters.*—Flat or slightly curved opaque cakes, often about  $1\frac{1}{2}$  inches long, 1 inch broad, and  $\frac{1}{10}$  to  $\frac{3}{8}$  inch thick, yellowish-grey to light green in colour, with a faint tea-like odour and a bitter acrid taste. It breaks easily and shows a finely granular fractured surface.

It should contain no carbonates or starch, and it should be soluble the extent of half its weight in boiling 90 per cent. alcohol.

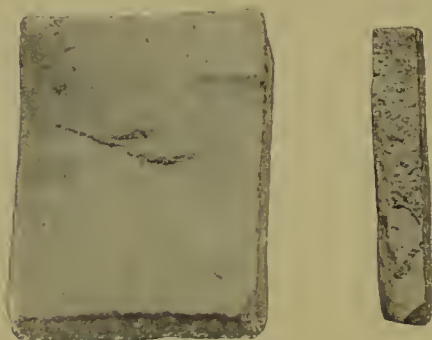


FIG. 74.

Elaterium, and section showing granular appearance. Natural size.

*Active Principle.* — The official crystalline neutral principle **Elaterin**.

Elaterin does not occur free in the plant. It is present as a glucoside, elaterinide, which is decomposed by a ferment, also occurring in the plant, as soon as the juice is expressed. This accounts for the increasing turbidity of the juice on standing, as elaterium is less soluble in aqueous media than elaterinide. A crystalline bitter glucoside, prophetin, and other unimportant substances are present in elaterium.

*Dose.*— $\frac{1}{10}$  to  $\frac{1}{2}$  grain.

*Pharmacology.*—It is a powerful purgative owing to the elaterin it contains. As the percentage of elaterin in different samples varies, it is advisable to employ the pure principle when the action of this substance is required.

**Elaterinum.**—‘The active principle of Elaterium.’

*Characters.*—Small colourless hexagonal scales or crystalline powder, without odour, and when pure almost without taste. Insoluble in water; slightly soluble in alcohol; soluble in 12 parts of chloroform.

When added to melted phenol it dissolves, forming a colourless solution, which becomes a deep scarlet colour on the addition of sulphuric acid. It should not give any characteristic alkaloid reaction, and on incineration should leave no ash.

The chemical constitution of elaterin is unknown. The empirical formula is given as  $C_{20}H_{28}O_5$ . When boiled with alcoholic potash it appears to be converted into a pharmacologically inactive acid substance.

*Dose.*— $\frac{1}{40}$  to  $\frac{1}{10}$  grain.

*Pharmacology.*—It is the most powerful purgative known. When given in full pharmacopœial doses it produces several copious watery motions, without much griping, but usually followed by well-marked prostration.

It is used occasionally as a hydrogogue purgative to aid in removing dropsical accumulations and waste products in the blood. It should be employed, however, with care, if at all, in heart disease, on account of the prostration it induces.

**Pulvis Elaterini Compositus.**—Consists of elaterin 1, milk sugar, 39.

*Dose.*—1 to 4 grains.

*Pharmacology.*—It is simply a convenient form for administering elaterin.

## MALE FERN

**Filix Mas.**—‘The rhizome of *Aspidium Filix-mas*, *Swartz*. Collected late in the autumn, divested of its roots,



FIG. 75.

Male fern rhizome and longitudinal section of a small portion.  $\frac{1}{2}$  linear.

leaves, and dead portions, and carefully dried.’ It ‘should not be kept more than a year.’



*Characters.*—The rhizome is covered with the dark-brown, curved, somewhat angular bases of the petioles, bearing numerous brown membranous scales. It is usually about 3 to 6 inches long, and  $\frac{3}{4}$  to 1 inch broad. The inner part of the base of the petioles, and the rhizome internally, should be green. The odour is faint and disagreeable; the taste is at first somewhat sweetish and astringent, afterwards bitter and acid.

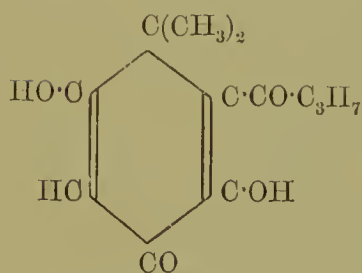
The transverse section of a petiole shows eight separate fibro-vascular bundles arranged in a circle. For the features distinguishing it from other ferns the student is referred to works on botany.

*Chief Constituents.*—**Filicic Acid**; **Aspidin**; **Albaspidin**; **Flavaspidic Acid**; **Aspidinin**.

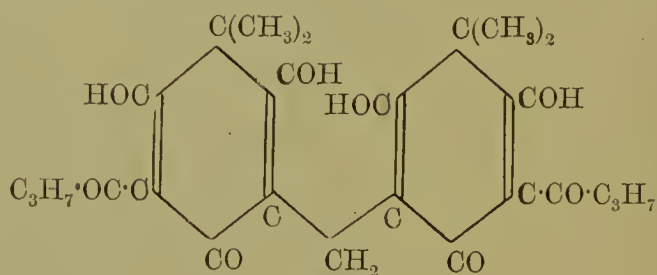
Other substances occurring in male fern are aspidinol, phloraspin, tannin (fili-tannic acid), fixed oil, a small quantity of a volatile oil.

The various active principles are derivatives of phloroglucin. They give, on decomposition, butyric acid, phloroglucin, and methylated phloroglucins. Filicic acid yields filicinic acid (probably 1,1-di-methyl-phloroglucin). Their activity appears to be dependent on the combination of a butyryl radical with a methyl-phloroglucin, since, while filicinic acid is inactive, butyro-filicinic acid is active.

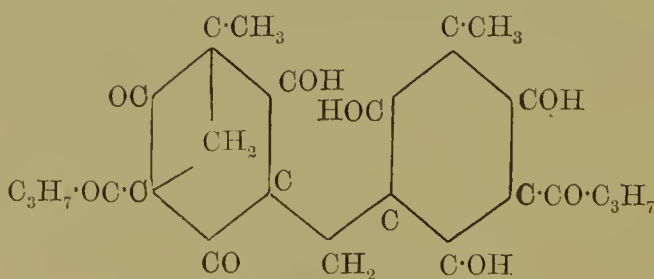
The following formulæ, which show the connection between these compounds, have been proposed:



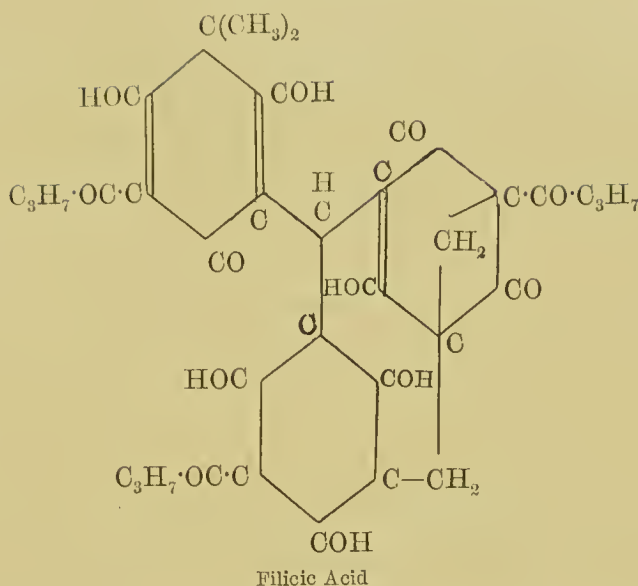
Butyro-filicinic Acid



Albaspidin



Flavaspidic Acid



The official liquid extract contains all the active ingredients of male fern.

**Extractum Filicis Liquidum.**—A greenish extract of a thick oily consistence. It is insoluble in water.

Prepared by extracting the rhizome with ether and subsequently evaporating off the ether.

*Dose.*—45 to 90 minims.

*Pharmacology.*—It has an unpleasant and somewhat nauseous taste, but when given by the mouth in pharmacopœial doses it usually produces no further effect. Occasionally it causes gastro-intestinal irritation (vomiting, abdominal pain, diarrhœa). Large doses have produced tremors, convulsions, inflammation of the kidneys, jaundice, and defective vision, which, in some cases, has terminated in blindness.

It is used solely in the treatment of tape-worms and *Anchylostomum duodenale* (another intestinal worm). The method commonly adopted in the treatment of tape-worms is to administer a purgative in the evening to clear out the bowels, and a full dose of liquid extract of male fern, made into an emulsion, the following morning.

The worm is usually passed in 4 to 6 hours, but it is sometimes necessary to administer a purgative to discharge

it. No food should be taken until the worm is passed. Castor-oil is the purgative commonly employed. It is said to increase the tendency of the extract of male fern to produce toxic effects, owing to being miscible with it and thus facilitating its absorption.

### KOUSSO

**Cusso.**—‘The dried panicles of pistillate flowers of *Brayera anthelmintica*, *Kunth*.’

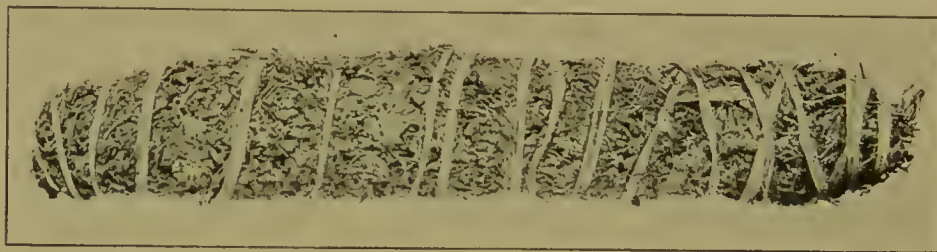


FIG. 76.

A hank of Cusso as imported.  $\frac{1}{4}$  linear.



FIG. 77.

Cusso flowers, taken from hank shown in previous figure.  $\frac{2}{7}$  linear.

*Characters.*—Usually imported in cylindrical rolls (hanks) about 1 to 2 feet in length, consisting of compressed reddish-brown panicles of pistillate flowers bound by a piece of grass. The flowers are shortly stalked; the calyx has reddish veins, and consists of two alternating whorls of five segments, the outer of which is alone obvious. The inner whorl is shrivelled and curved inwards, covering the young fruit. As ordinarily seen, the drug consists of broken flowers and hairy stalks. It has no distinctive odour, but has a bitter acrid taste.

*Active Principle.*—**Kosotoxin**, an amorphous substance insoluble in water, but soluble in alcohol and alkaline fluids.

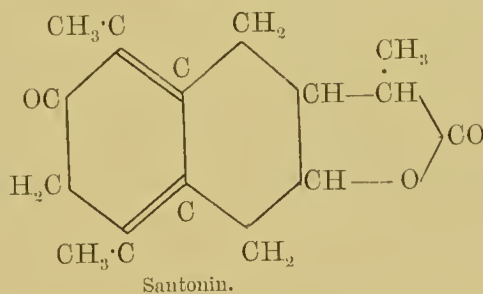
A crystalline substance, protokosin, has been isolated, but appears to be inactive. The drug contains also a bitter acrid resin, koussin or tæniin, tannin, and a small quantity of volatile oil.

*Dose.*— $\frac{1}{4}$  to  $\frac{1}{2}$  ounce.

*Pharmacology.*—It has a bitter, somewhat acrid taste, and sometimes produces nausea, vomiting, colic, and diarrhoea. It is used in the treatment of tape-worm, but is less certain than oil of male fern. The powder is given suspended in water. A purgative subsequently is usually unnecessary. It is rarely employed in this country.

## SANTONIN

**Santoninum.**—‘A crystalline principle,  $C_{15}H_{18}O_3$ , prepared from santonica, the dried unexpanded flower-heads or capitula of *Artemisia maritima*, *var.* *Stechmanniana*, *Besser.*’



*Characters.*—Colourless, glistening, tabular or prismatic crystals, without odour, but with a feebly bitter taste. When exposed to sunlight it becomes yellow, owing to the formation of photo-santonin. Soluble in 5,000 parts of water, in 40 parts of alcohol, and in 2 parts of chloroform; slightly soluble in ether and fixed oils.

Melting-point, 169° to 170°C. When warmed with alcoholic potash solution it forms an orange-red solution. If, to 2 or 3 drops of an alcoholic solution, 1 or 2 drops of a 2 per-cent. solution of furfurol in alcohol, and afterwards 30 to 40 drops of sulphuric acid are added and the mixture warmed, it becomes greenish-yellow and then claret-coloured, and, on further heating, darkens and finally chars. Veratrine and picrotoxin give a similar reaction, but veratrine, when heated with a cooled mixture



of sulphuric acid and an equal volume of water, forms a deep-scarlet solution; santonin forms a pale-magenta solution, which disappears on further heating, but becomes deep violet on the addition of a drop of ferric chlorido solution to the boiling mixture; picrotoxin gives no characteristic reaction under similar conditions.

*Dose.*—2 to 5 grains.

*Pharmacology.*—It has a slightly bitter taste. In full pharmacopœial doses it produces yellow vision (xanthopsia), but, as a rule, no other symptoms. Large doses produce nausea, vomiting, giddiness, convulsions commencing in the face, hallucinations, irritation of the kidneys, and often violet vision. The urine is yellow or greenish yellow when passed, and becomes purplish when made alkaline.

It is used solely in the treatment of round worm (*Ascaris lumbricoides*), and it is advisable to administer it at night in order that the yellow vision, which usually passes away in a few hours, may cause no inconvenience. Two or three doses on alternate nights, followed by a purgative the following morning, are usually necessary. It is often given in castor oil.

**Trochiscus Santonini.**—Each lozenge contains 1 grain of santonin. Simple basis.

*Pharmacology.*—A useful form to give santonin to children.

## ERGOT

**Ergota.**—‘The sclerotium of *Claviceps purpurea*, *Tulasne*, originating in the ovary of *Secale cereale*, *Linn.*’

*Characters.*—Hard, violet-black, elongated, roughly cylindrical, but tapering towards both ends, generally curved (*i.e.* somewhat banana-shaped), often irregularly cracked, and marked with a longitudinal furrow on the concave and convex sides. They vary in length from  $\frac{1}{3}$  to  $1\frac{1}{2}$  inches. The fracture is short, and the

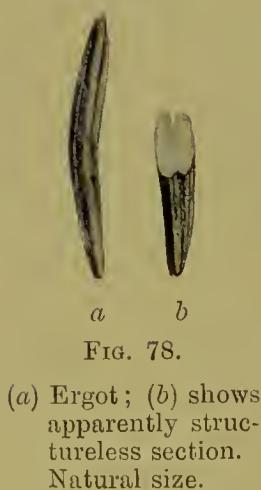


FIG. 78.

(a) Ergot; (b) shows apparently structureless section. Natural size.

fractured surface is whitish or slightly pinkish, but shows no

obvious structure even when examined under a lens. The odour is characteristic and disagreeable; the taste is disagreeable. Ergot deteriorates by keeping, especially if exposed to damp.

Ergots develop on various kinds of cereals, but that obtained from rye is alone official. The spores (ascospores) of the fungus settle on the flowers of the rye, germinate, and penetrate into the ovary, where a felt-like mycelium is formed. This sends up hyphæ, which form gonidia, and these are carried by insects, at-



FIG. 79.

Ergot growing on rye.  
Natural size (after  
Luerssen).



FIG. 80.

Germinating Ergot: (a) early, (b) later stage. Natural size (after Luerssen).

tracted by a sweet secretion ('honeydew') formed by the fungus, to other flowers. The gonidia develop a mycelium similar to that produced by the ascospores. The mycelium pushes aside the ovary, which ceases to develop, and later in the summer it forms at the base a compact mass (the sclerotium) which enables it to resist the cold and damp of winter. It is fully developed about the time the rye is ripe (fig. 79). This is ergot. If placed in moist soil under suitable conditions it sends up fleshy pink stalks which form rounded globular heads (fig. 80) in which the ascospores develop.

*Active Principle.*—**Sphacelotoxin**, a non-nitrogenous, unstable, resinous substance.

It appears to be combined in the drug in two forms, chrysotoxin and secalintoxin. Chrysotoxin yields sphaecelotoxin and an inactive substance, ergochrysin. Secalintoxin yields sphaecelotoxin and a crystalline inactive alkaloid, secaline.

Other active principles—cornutine, ergotinine, &c.—have been described, but they do not appear to produce the typical action of ergot. The chemistry of ergot is still in an unsatisfactory state.

Ergot also contains ergotinic acid (a saponin), about 30 per cent. of fatty matter, and small quantities of choline, mannite, and other unimportant substances.

*Dose.*—20 to 60 grains.

*Pharmacology.*—The predominant action of ergot is on unstriated muscular fibre, especially that of the pregnant uterus and the blood-vessels. It has also an action on the nervous system.

When taken by the mouth in full pharmacopœial doses it has an unpleasant characteristic and nauseous taste, and frequently induces vomiting. It is fairly rapidly absorbed, and then causes contraction of the blood-vessels and a rise in the arterial pressure. This, however, is not usually marked, owing partly to the gradual absorption and partly to slowing of the heart, which is produced by stimulation of the cardio-inhibitory centre. The pregnant uterus is powerfully contracted. If a preparation of ergot is injected into the circulation a notable rise of blood-pressure occurs, which is still more marked if the vagi have been previously divided.

When taken in large doses ergot produces gastro-intestinal irritation, difficulty of respiration, precordial pain, muscular weakness, paræsthesia, and, later, numbness in the limbs, more or less marked convulsions, symptoms of collapse, and other symptoms of a variable nature. If recovery occur, symptoms of chronic poisoning may develop later.

Chronic poisoning—**ergotism**—has been seen most commonly after eating ergotised (‘spurred’) rye. The symptoms develop slowly. The individual feels indisposed; there is headache, a disinclination for food, usually diarrhœa, muscular weakness, sleeplessness, and paræsthesia in the limbs. Later, the symptoms generally assume one of two fairly definite forms, known as *Ergotismus convulsivus* and *Ergotismus*

*gangrenosus*. In the convulsive form the fingers and toes, and sometimes the whole limb, become contracted, and convulsions (tonic or clonic) of the whole body or of groups of muscles occur. In the gangrenous form the paræsthesia in the extremities is succeeded by anæsthesia, and this is usually followed by dry gangrene. Whole fingers or toes, or even a fore-arm or leg, may die and be thrown off. Other symptoms may occur in both forms.

Ergot and its preparations are used mainly in the treatment of inaccessible hæmorrhage, and in the last stage of child-birth, to aid in the expulsion of the fœtus and ensure a more efficient contraction of the uterus subsequently. It has also been used in atony of the bladder, in chronic constipation, and in a few other diseases. Its use in the treatment of hæmorrhage, especially hæmorrhage from the lungs, has led to some difference of opinion, and it is used much less now than formerly.

It is necessary to emphasise the fact that different samples of ergot vary in activity, and that ergot deteriorates by keeping.

**Extractum Ergotæ.**—‘Ergotin.’ A soft extract.

Prepared by a somewhat complicated process, for which see the Pharmacopœia. (Compare also page 23).

*Dose.*—2 to 8 grains.

*Pharmacology.*—It is used, in the form of pills, to obtain a mild and prolonged action of ergot. It has been employed in continued hæmorrhage from various organs and in the treatment of chronic constipation, vesical atony, and other conditions.

**Injectio Ergotæ Hypodermica.**—Contains one-third its weight of extract of ergot. It should be freshly prepared.

Extract of ergot, 100 gr.; phenol, 3 gr.; distilled water, boiled and cooled, 220 minims.

*Dose, by subcutaneous injection.*—3 to 10 minims.



*Pharmacology.*—It acts in a few minutes, and is consequently employed when a rapid action is required. As it produces irritation, it is best injected into the muscles.

**Extractum Ergotæ Liquidum.**—Contains the active ingredient of 1 ounce of ergot in 1 fluid ounce.

*Dose.*—10 to 30 minims.

*Pharmacology.*—It is a preparation largely used for administration by the mouth.

**Infusum Ergotæ.**—One ounce of ergot is made into 1 pint of infusion.

*Dose.*—1 to 2 fluid ounces.

*Pharmacology.*—It is an efficient preparation when freshly made, but is rarely prescribed.

**Tinctura Ergotæ Ammoniata.**—Contains the active ingredients of 5 ounces of ergot and 2 fluid ounces of solution of ammonia in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—The addition of the ammonia was believed to produce a better tincture. Its greatest value is probably as a stimulant, counteracting the undesirable effects produced by the ergot. It is a favourite preparation of many practitioners.

## PICROTOXIN

**Picrotoxinum.**—‘A neutral principle obtained from the fruits of *Anamirta paniculata*, *Colebr.*’

*Characters.*—Small colourless acicular or prismatic crystals or crystalline powder, without odour, but with a very bitter taste. Soluble in 340 parts of water, and in 13 parts of alcohol; readily in chloroform.

Melting-point, 201°C. ? If a small quantity is boiled with a few c.c. of 10 per-cent. caustic potash solution and 2 or 3 drops of Fehling's solution added, reduction of the latter to red copper oxide occurs. It reduces ammoniacal silver solution on warming. If mixed with about three parts of powdered potassium nitrate, and the mixture moistened with

sulphuric acid and a few drops (excess) of strong caustic soda solution (1 in 1) added, the mixture becomes reddish, the particles of pierotoxin becoming cherry-red. If a few drops of a 20 per-cent. solution of benzaldehyde in absolute alcohol are added to a small quantity of pierotoxin and a drop of sulphuric acid added to the mixture, it becomes of a scarlet-red colour. See also page 443. Pierotoxin does not give the characteristic alkaloidal tests.

Very little of the chemistry of this substance is known. The empiric formula is variously given as  $C_{15}H_{16}O_6$ ,  $C_{30}H_{31}O_{13}$ , and  $C_{36}H_{40}O_{16}$ . It very easily decomposes into pierotoxinin (about two-thirds), a powerfully poisonous substance, and pierotin (about one-third), which is pharmacologically inactive.

*Dose.*— $\frac{1}{100}$  to  $\frac{1}{25}$  grain.

*Pharmacology.*—It is a convulsant. If given in  $\frac{1}{2}$  grain doses by the mouth it produces after a short interval clonic convulsions, usually commencing in the face and rapidly extending over the body, and often terminating in a tonic convulsion. This is followed by a period of exhaustion, which is succeeded by another convulsion; and the alternation may continue. Death may occur from respiratory failure in any convulsion, or from exhaustion. Other symptoms, both primary and secondary, are present, but as poisoning by this substance is rare, they need not be specified.

The convulsions are due to an action on the brain above the medulla, probably (certainly in rabbits) the basal ganglia. The medullary centres are also stimulated.

In small doses, stimulation of the medullary centres is the most important action. When taken by the mouth in solution it has a bitter taste and consequently acts as a bitter, but it is not used for this purpose.

It has been employed in the treatment of the night sweats of phthisis, and in certain forms of paralysis (bulbar, &c.) It has also been used as a 2 per cent. ointment to destroy pediculi, but, on account of its toxic action, is not to be recommended.

## INDIAN HEMP

**Cannabis Indica.** — ‘The dried flowering or fruiting tops of *Cannabis sativa*, *Linn.*, grown in India; from which the resin has not been removed.’

The common hemp, when grown in temperate regions, yields a valuable fibre, but in tropical countries, under certain conditions of cultivation, the female plant produces a narcotic resin. This is collected, and in its crude state is sold as charas (churrus). The flowering tops from which the resin has not been removed are also collected, and after being stamped into masses by the feet of native men are sold as gánjá (gunjah). This is the official Indian hemp. It deteriorates by keeping.



FIG. 81.

Indian Hemp (gánjá).  
 $\frac{1}{2}$  linear.

*Characters.*—Flattened, rough, dusky-green masses, consisting of the upper part of the stem, with the leaves, flowers and fruits matted together by a resinous secretion; usually about 6 to 7 inches long and 1 inch broad. It has a characteristic odour and taste. The resinous secretion is most obvious when the drug is fresh. By keeping, the tops become dry and even brittle.

*Active Principle.*—**Cannabinol**, a transparent, light-brown substance of the consistence of thick treacle; insoluble in water, slightly soluble in alkaline solutions, readily soluble in organic solvents. It undergoes oxidation, when exposed to the air, and loses its activity.

Its constitution is unknown. It contains an alcoholic hydroxyl group, and yields on oxidation with fuming nitric acid certain fatty acids and nitro-cannabino-lactone (oxy-cannabin).

Indian hemp also yields a terpene, a sesquiterpene, and other unimportant substances.

*Pharmacology.*—The most characteristic action is a curious intoxication. After moderate doses of a preparation taken by the mouth, the effects usually commence within half-an-hour. There is loss of mental power, a feeling of supreme happiness, an indifference to surroundings, and a curious sense of the ludicrous. The simplest occurrence may send the individual into uncontrollable fits of laughter. Hallucina-

tions of the most grotesque character, which the individual knows to be grotesque, but cannot control, occur. There is inability to estimate time—minutes often seeming like hours—and, to a less extent, distance. Periods of excitement alternate with apparently rational periods. The individual falls asleep, or the lucid intervals increase in duration and recovery occurs.

The effects vary largely with the individual. The peoples of the East smoke Indian hemp or take it as a sweetmeat or beverage to produce a pleasant phantasy, but unpleasant depression is often the only noteworthy symptom experienced by the more prosaic peoples of the West. The effect also varies with the time of the day and other conditions. If taken late in the evening, sleep as a rule quickly follows, and the more characteristic symptoms are not felt.

Preparations of Indian hemp have been given in a large number of diseases, but it is doubtful if this drug possesses any therapeutic effects which cannot be obtained by the use of other and more reliable drugs. It appears, however, to be useful in headache of a dull continuous character. The extract in the form of pills is usually administered.

**Extractum Cannabis Indicæ.**—An alcoholic extract.

*Dose.*— $\frac{1}{4}$  to 1 grain.

**Tinctura Cannabis Indicæ.**—Contains 1 ounce of the extract in 20 fluid ounces.

*Dose.*—5 to 15 minims.

## CIMICIFUGA

**Cimicifugæ Rhizoma.**—‘The dried rhizome and roots of *Cimicifuga racemosa*, *Ell.*’

*Characters.*—Hard, blackish-brown, irregular pieces, up to 6 inches in length, consisting of the rhizome, stout ascending branches and brittle roots. The rhizome is largely hidden by the branches and roots. The ascending branches are longitudinally wrinkled, marked with the scars of encircling leaves and often terminate in a cup-shape depression. The roots are brittle and are generally broken off near the rhizome. They



show a characteristic transverse section, three to five somewhat wedge-shaped wood-bundles being separated by wide



FIG. 82.

*Cimicifuga*, showing stout ascending branches and roots. Natural size.

medullary rays; the appearance is frequently cruciate. The odour is somewhat unpleasant; the taste, bitter and acrid.

*Chief Constituents*.—**Cimicifugin** or racemosin, a bitter acrid crystalline substance. Two resins (to a mixture of which the name, cimicifugin, is also applied).

The blackening observed when the rhizome is treated with ferric chloride solution is said to be due, not to tannin, but to a substance allied to quercetrin.

*Pharmacology*.—It has an acrid bitter taste and acts to some extent as a bitter. It is also said to have an action on the heart and blood-vessels like that of *digitalis*, and to contract the uterus. It has been tried in a number of diseases (dyspepsia, amenorrhœa, neuralgia, chorea, rheumatism, bronchitis, &c.), but is now rarely used.

**Extractum Cimicifugæ Liquidum**.—Contains the active ingredients of 1 ounce of the drug in 1 fluid ounce.

The menstruum is 90 per cent. alcohol.

*Dose*.—5 to 30 minims.

**Tinctura Cimicifugæ.**—Contains the active principles of 1 ounce of drug in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

## DRUGS CONTAINING BITTER PRINCIPLES.

A number of drugs are employed for their so-called bitter action. Some of these contain principles having a pure bitter taste and bitter action, but in many cases the bitter principle is associated in the drug with a volatile oil or other substance, or it may possess a somewhat acrid taste or a more or less specific action. These drugs may therefore be divided into

Pure bitters — calumba root, quassia wood, chiretta, gentian root.

Aromatic bitters—cascarilla, bitter-orange peel, chamomile flowers, hops.

Acrid bitters—dandelion root (cimicifuga ; see page 452).

Bitters with a more or less specific effect—nux vomica and cinchona bark are the chief.

But all substances possessing a bitter taste (alkaloids, &c.) possess to a greater or less degree a bitter action, although they may not be used as such. In many cases the bitter taste is an undesirable effect.

*The Pharmacological Action of a Bitter.*—The action of a bitter is due mainly to its bitter taste, to a slight extent to a mild stimulant action on the mucous membrane of the stomach. A bitter taste cleanses the palate and stimulates the appetite, it induces slight reflex salivation, and, probably reflexly, increased gastric secretion. The bitter taste is usually persistent, so that these effects last for some time, but to obtain the best results bitters should be given before meals. In the stomach, in virtue of a mild stimulant action, bitters cause slight increase of gastric secretion. They have no accelerating influence on the digestive process itself; in moderate amounts they even tend to retard it. The main effect of bitters is largely psychological and consequently

varies in different individuals. Many persons can bear with impunity, and even enjoy, a bitter taste which in others would produce nausea and possibly vomiting. Large doses have a nauseously bitter taste and may produce vomiting both reflexly through the mouth and by a direct action on the stomach. They also have, usually, a slight laxative effect. They are absorbed to a greater or less degree but produce no general symptoms, except after large doses in a few cases, and these are not of sufficient practical importance to merit consideration.

Aromatic bitters have a similar action to pure bitters. On account of their more agreeable taste, they are usually better borne, and, in virtue of the volatile oil they contain, produce a more distinct reflex effect through the mouth and direct action on the stomach. (See the action of volatile oils, page 469.)

Acrid bitters have also a similar action, but are not used therapeutically as such.

Bitters with other pronounced effects have been described in other pages. When used mainly for their bitter action they should be given in small doses before meals ; if employed for their other effects it is generally advisable to administer them after meals.

Bitters are used chiefly to stimulate the appetite in convalescence, chronic gastric diseases, debility, and various other conditions. For this purpose they should be given before meals, or, if administered as beverages, with food. It is almost immaterial which bitter is employed. An infusion of some of the bitters, more especially quassia wood, is sometimes used as an enema for thread-worms in children.

#### CALUMBA ROOT

**Calumbæ Radix.**—‘The dried transversely cut slices of the root of *Jateorhiza Columba*, *Miers*.’

*Characters.*—Large, yellowish, irregularly circular, disc-shaped slices, depressed towards the centre, with a thick cortex separated by a dark line (cambium) from the central woody

portion, and a brownish wrinkled cork. The pieces are usually from 1 to 2 inches broad, and from  $\frac{1}{8}$  to  $\frac{1}{2}$  inch thick.

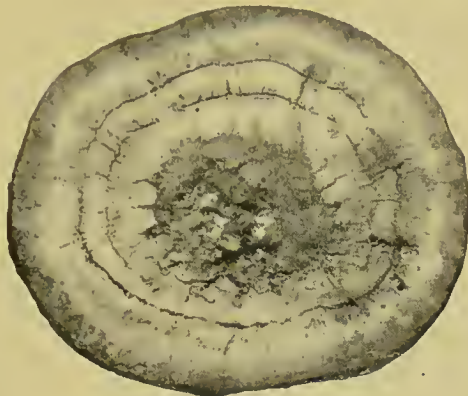


FIG. 83.

Calumba root, showing appearance of sliced surface. Natural size.

They have a short starchy fracture, a feeble odour, and a very bitter taste.

The drug is bleached somewhat by exposure to light, and becomes of a greyish colour; but if scraped the yellow colour is again obvious.

*Chief Constituents.*—**Columbin**, a colourless crystalline substance, the anhydride of columbic acid; columbic acid, colourless and crystalline; berberine, a yellow crystalline alkaloid. Starch (about 30 per cent.). It contains no tannin, and is therefore compatible with solutions of iron salts.

**Infusum Calumbæ.**—Contains the active ingredients of 1 ounce of drug in 20 fluid ounces.

It is prepared with cold water to avoid extracting the starch as a mucilage, which would interfere with the taste, appearance, and keeping qualities of the infusion.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Liquor Calumbæ Concentratus.**—Contains the active ingredients of 1 ounce of drug in 2 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Calumbæ.**—Contains the active principles of 1 ounce of drug in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.



## QUASSIA WOOD

**Quassiæ Lignum.** — ‘The wood of the trunk and branches of *Picræna excelsa*, *Lindl.*’

*Characters.*—It is imported in logs of various sizes, but is seen usually in the form of chips. The wood is yellowish-



FIG. 84.

- (a) Section of a log of Quassia wood.  $\frac{1}{2}$  linear.  
 (b) A large chip.  $\frac{2}{3}$  linear.

white in colour, is easily split, and has an intensely bitter taste but no odour.

*Active Principle.*—**Picrasmin**, a mixture of  $\alpha$ -picrasmin and  $\beta$ -picrasmin, two homologous, crystalline substances.

It contains no tannin, and may therefore be prescribed with salts of iron.

The two picrasmins yield picrasmic acid when heated with hydrochloric acid.

The closely allied quassin is obtained from Surinam quassia (*Quassia amara*), which is not official.

**Infusum Quassiæ.**—Contains the bitter principle of 1 ounce of quassia wood in 100 fluid ounces.

It is made with cold water because the bitter principle is sufficiently soluble in cold water to make it unnecessary to use boiling water.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Liquor Quassia Concentratus.**—Contains the bitter principle of 1 ounce of quassia wood in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Quassia.**—Contains the bitter principle of 1 ounce of quassia wood in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

The tincture has a more powerful bitter taste than the concentrated liquor, although they are apparently of the same strength.

## CHIRETTA

**Chirata.**—‘The dried plant, *Swertia Chirata*, *Ham.*, collected when in flower.’

*Characters.*—The herb may be 3 feet or more in length. The stem is rounded in the lower, slightly winged in the upper portion, smooth, yellowish-brown or purplish-brown in colour, and about  $\frac{1}{4}$  inch in diameter. On section it shows a large easily separable pith. Numerous slender branches which further subdivide arise from the upper portion in a decussate manner. The leaves are ovate to lanceolate, acuminate, entire, glabrous, opposite, and sessile. The flowers are small and paniced, and have a yellow corolla, but are frequently absent in the dried herb. The fruits are superior, unilocular but bicapellary, and contain numerous small seeds. The drug has no distinctive odour but a very bitter taste. The root is generally present, but is detached before use.

*Chief Constituents.*—**Chiratin**; ophelic acid. Tannin. (Preparations of chiretta are therefore incompatible with preparations of iron.)

Chiratin, a yellow crystalline substance, is decomposed by heating with dilute acids into ophelic acid and chiratogenin.



FIG. 85.

Chiretta: (a) lower part; (b) middle portion; (c) upper part of dried herb.  $\frac{1}{7}$  linear.

**Infusum Chirataë.**—Contains the bitter principles of 1 ounce of drug in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Liquor Chirataë Concentratus.**—Contains the bitter principles of 1 ounce of drug in 2 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Chirataë.**—Contains the bitter principles of 1 ounce of drug in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

## GENTIAN ROOT

**Gentianæ Radix.**—‘The dried rhizome and roots of *Gentiana lutea*, *Linn.*’

*Characters.*—The drug is yellowish-brown in colour. The rhizome is nearly cylindrical, varies in length up to 1 foot or more, but rarely exceeds 1 inch in thickness, is marked with closely approximated leaf-scars, and usually terminates in one or two buds. It gives off long roots which are much shrivelled and longitudinally wrinkled, and which, when moist, are



FIG. 86.

Gentian rhizome and roots.  $\frac{2}{3}$  linear.

tough, but when dry, brittle. The fractured surface is almost uniformly reddish-yellow and porous; it shows no distinct radiate arrangement, but a darker cambium line is seen to separate the thick bark from the central woody portion. The odour is characteristic; the taste is at first sweetish, then bitter. The rhizome is frequently divided longitudinally to facilitate drying.

The root can be distinguished from the rhizome by its more shrivelled appearance, the marked longitudinal wrinkles, and the absence of close transverse annulations.

*Active Principle.*—**Gentiopicrin**, a crystalline bitter glucoside (about 0.1 per cent.).

It occurs in pale-yellow crystals soluble in water and in dilute alcohol. It is hydrolysed by dilute hydrochloric acid into glucose and gentiogenin, an amorphous bitter substance.

Gentianin (gentisin), a pale-yellow crystalline substance which forms in alkaline solutions an intensely yellow colour, a sugar (gentianose), and a trace of a volatile oil, also occur.



The darkening observed when preparations of gentian root are combined with salts of iron is apparently due not to the presence of tannic acid, but to a compound termed gentianic or gentisic acid.

**Extractum Gentianæ.**—An aqueous extract.

*Dose.*—2 to 8 grains.

*Pharmacology.*—It has no action of importance. It is used solely as a pill excipient.

**Infusum Gentianæ Compositum.** — Gentian root  $\frac{1}{4}$  ounce ; dried bitter-orange peel  $\frac{1}{4}$  ounce ; fresh lemon peel  $\frac{1}{2}$  ounce ; boiling distilled water 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—The orange and lemon peels give it a very pleasant flavour, and it is consequently a popular preparation. Its action is that of an aromatic bitter.

**Tinctura Gentianæ Composita.**—Contains the bitter principle of 1 ounce of gentian root and a little bitter orange peel and cardamom seeds in 10 fluid ounces.

Gentian root, 2 oz.; dried bitter-orange peel,  $\frac{3}{4}$  oz.; cardamom seeds,  $\frac{1}{4}$  oz.; alcohol (45 per cent.), 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has the action of an aromatic bitter.

## CASCARILLA

**Cascarilla.**—‘The dried bark of Croton Eluteria, *J. J. Bennett.*’

*Characters.*—Channelled pieces or quills from 1 to 4 inches long, and  $\frac{1}{6}$  to  $\frac{1}{2}$  inch broad, with a somewhat chalky cork (due to the presence of calcium oxalate) which is longitudinally wrinkled and usually marked with longitudinal and transverse cracks. Small black dots (apothecia of a lichen) are frequently scattered over the chalky surface. The cork

separates easily, and is usually more or less denuded in the drug, showing a dull-brown or dark-grey cortex. The fracture

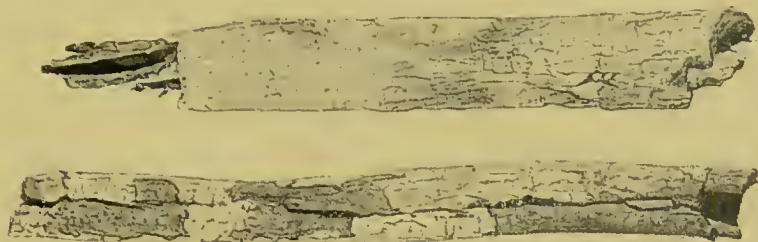


FIG. 87.

Cascarilla, showing chalky cork (patchy in the lower quill) with longitudinal and transverse cracks. Natural size.

is short and resinous. The odour is aromatic; the taste aromatic and bitter.

On examination with a lens the transverse section shows narrow whitish medullary rays running through the dark reddish-brown bast. It should show no groups of sclerenchymatous cells.

*Chief Constituents.*—**Cascarillin**, a bitter crystalline substance; a **volatile oil** (1 to 3 per cent.); tannin (small quantities).

It contains also small quantities of resins and betain.

**Infusum Cascarillæ.**—Contains the active ingredients of 1 ounce of cascarilla in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Tinctura Cascarillæ.**—Contains the active principles of 1 ounce of cascarilla in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

#### BITTER-ORANGE PEEL

Both fresh and dried bitter-orange peel are official. There is also a water prepared from the flowers of the plant (see page 506).

**Aurantii Cortex Recens.**—‘The fresh outer part of the pericarp of *Citrus Aurantium*, var. *Bigaradia*, *Hook. f.*’

*Characters.*—It differs from the peel of the sweet orange in being rougher and more orange-red in colour, and in possessing a bitter taste. Most of the white spongy inner portion should have been removed. On section numerous large oil-glands can be seen in the yellow outer portion. The odour is pleasantly aromatic and characteristic.

*Chief Constituents.*—**Aurantiamarin**, an amorphous glucoside; aurantiamaric acid; a **volatile oil** (1 to 2 per cent.).

It also contains hesperidin, a colourless, tasteless, crystalline glucoside, which yields on hydrolysis rhamnose, glucose, and hesperetin, a phloroglucin derivative; and iso-hesperidin, a similar glucoside.

**Tinctura Aurantii.**—Contains the active ingredients of 1 ounce of fresh bitter-orange peel in 4 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Syrupus Aurantii.**—Consists of tincture of orange 1; syrup 7; by volume.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has a mild bitter action, but is used mainly as a flavouring agent.

**Syrupus Aromaticus.**—Consists of tincture of orange 1; cinnamon water 1; syrup 2; by volume.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is a useful flavouring syrup.

Tincture of orange is used in the preparation of **Tinctura Quininae**, **Syrupus Cascaræ Aromaticus**, **Confectio Sulphuris**, and **Trochiscus Sulphuris**.

**Vinum Aurantii.**—‘Wine made by the fermentation of a saccharine solution to which fresh bitter-orange peel has been added.’

*Characters.*—A golden sherry-coloured liquid, containing 10 to 12 per cent. of ethyl hydroxide, and having the taste and aroma of bitter-orange peel.

It should not be more than slightly acid, and should contain no salicylic acid and not more than traces of sulphites.

**Vinum Ferri Citratis.** See page 177.

**Vinum Quininæ.**—See page 297.

**Aurantii Cortex Siccatus.**—‘The dried outer part of the pericarp of *Citrus Aurantium*, var. *Bigaradia*, *Hook. f.*’

*Characters.*—Similar to the fresh peel, but dry and in thin strips. There should not be more than a very small amount of the white spongy portion on the inner surface.

The bitter taste serves to distinguish it from the rind of the sweet orange or the lemon.

*Active Principles.*—See page 462.

**Infusum Aurantii.**—Contains the active principles of 1 ounce of dried peel in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Infusum Aurantii Compositum.**—Dried bitter-orange peel  $\frac{1}{2}$  ounce ; fresh lemon peel  $\frac{1}{4}$  ounce ; cloves 55 grains ; boiling distilled water, 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—The lemon peel and the cloves give this preparation a pleasant taste and a more distinct aromatic action.

Dried bitter-orange peel is used in preparing **Infusum Gentianæ Compositum**, **Tinctura Gentianæ Compositum**, **Tinctura Cinchonæ Composita**, **Spiritus Armoracæ Compositus**.

## CHAMOMILE FLOWERS

**Anthemidis Flores.**—‘The dried expanded flower-heads of *Anthemis nobilis*, *Linn.*, collected from cultivated plants.’

*Characters.*—White or slightly yellowish flattened flower-heads, about  $\frac{1}{2}$  to  $\frac{3}{4}$  inch in diameter, composed of numerous ligulate florets arising from a solid conical receptacle. By



carefully removing the florets the receptacle is seen to be covered with concave, blunt, narrow scaly bracts. The odour

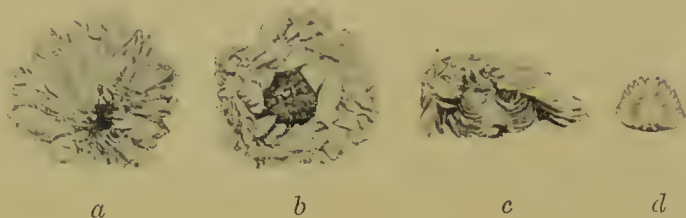


FIG. 88.

Chamomile flowers: (a) upper surface; (b) under surface; (c) section showing solid receptacle with bracts; (d) receptacle with bracts after the florets have been removed. Natural size.

is aromatic and characteristic; the taste is bitter and somewhat nauseous.

*Active Principles.*—The official **volatile oil** (0·8 to 1 per cent.); **anthemic acid**, a bitter principle.

The volatile oil consists of isobutyl isobutyrate and angelate, amyl and hexyl angelates and tiglates, anthemol esters, and other substances.

**Extractum Anthemidis.**—An aqueous extract containing a little added oil of chamomile.

*Dose.*—2 to 8 grains.

*Pharmacology.*—It is mainly carminative. It forms a useful excipient for making more solid substances into pills.

**Oleum Anthemidis.**—‘The oil distilled from chamomile flowers.’

*Characters.*—When freshly distilled it is pale blue or greenish blue, but it gradually becomes brownish on keeping. It has the characteristic odour of the flowers.

Specific gravity, 0·905 to 0·915.

It is contained in the extract (see above).

*Dose.*— $\frac{1}{2}$  to 3 minims.

*Pharmacology.*—It has the action common to volatile oils (see page 469). It is mainly used as a carminative.

## HOPS

**Lupulus.**—‘The dried strobiles of *Humulus Lupulus*, *Linn.*; collected from cultivated plants.’

*Characters.*—Compressed ovoid strobiles, about  $1\frac{1}{4}$  inches long, consisting of small greenish-yellow leaf-like structures (bracts and stipules) arranged on a zigzag axis (seen by removing the bracts and stipules). Both bracts and stipules



FIG. 89.

Hop: (a) dried strobile; (b) zigzag axis after removal of bracts and stipules; (c) a bract enclosing rounded fruit at base; the black dots are the yellow oil-glands. Natural size.

are sprinkled with yellow glands (the official lupulin; see below), and near the base the bracts enclose a small rounded fruit (an achene) which is also covered with yellow glands. The odour is aromatic and characteristic; the taste is aromatic, bitter, and somewhat astringent.

*Active Principles.*—**Lupumaric acid**, a crystalline bitter substance; a **volatile oil** (about 0·7 per cent.). Tannin (lupulo-tannic acid, 4 to 5 per cent., but said to diminish by keeping).

Other unimportant substances occur. The oil consists mainly of a sesquiterpene, humulene, and small quantities of oxygenated compounds which give the characteristic odour.

*Pharmacology.*—The action of hops is that of an aromatic bitter. It has erroneously been credited with valuable soporific effects.

**Infusum Lupuli.**—Contains the active ingredients of 1 ounce of hops in 20 fluid ounces.

*Dose.*—1 to 2 fluid ounces.

**Tinctura Lupuli.**—Contains the active principles of 1 ounce of hops in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Lupulinum.**—‘Glands obtained from the strobiles of *Humulus Lupulus*, *Linn.*’

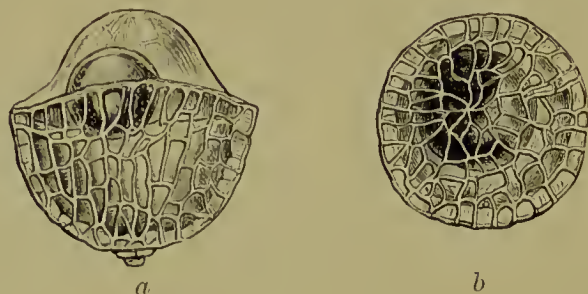


FIG. 90.

Lupulin: (a) side view; (b) seen from below.  $\times 100$  (after Vogl).

*Characters.*—A brownish-yellow granular powder, with a hop-like odour and taste.

Microscopically examined it is seen to consist of small glands composed of a hemispherical layer of cells, the cuticle of the concave portion of which has been raised by the secretion of the oil or oleo-resin within the gland.

Commercial lupulin usually contains a considerable amount of sandy matter owing to its having been prepared by merely sifting the sweepings of hop-kilns. The Pharmacopœia consequently states that ‘it should contain not more than 40 per cent. of matter insoluble in ether and yield not more than 12 per cent. of ash when incinerated.’

*Active Principles.*—**Lupumaric acid**; a volatile oil (about 3 per cent.).

*Dose.*—2 to 5 grains.

*Pharmacology.*—It is said to be hypnotic, but it does not possess any such action in doses many times larger than

those recommended by the Pharmacopœia. Its action is chiefly that of an aromatic bitter.

## DANDELION ROOT

The fresh and dried roots are official.

**Taraxaci Radix.**—‘The fresh and dried roots of *Taraxacum officinale*, *Wiggers*. Collected in the autumn.’

*Characters.*—The fresh root has a plump appearance, is yellowish-brown in colour, and frequently a foot or more in length. At the upper end it frequently divides into two or more erect branches. It breaks with a short fracture. The fractured surface shows a small central wood and a thick white cortex, which is marked with faint concentric rings, from which drops of a milky fluid (latex), with an acrid, bitter taste, quickly exude.

The dried root is dark brown in colour, longitudinally wrinkled, and much shrivelled. It breaks with a short fracture, and the fractured surface shows a small, yellow, porous wood and a thick, whitish cortex, marked with a number of irregular, concentric rings. It has no distinct odour, but has a bitter taste.

Compare with Pellitory Root (page 289).

*Active Principles.*—**Taraxacin**, a crystalline, bitter substance ; **Taraxacerin**, an amorphous, acrid compound.



FIG. 91.

- (a) Fresh dandelion root.  
(b) Dried dandelion root.  
 $\frac{3}{4}$  linear.



*Pharmacology*.—It has, erroneously, been accredited with an action on the liver. It is a somewhat acrid bitter, and has also a slight laxative action. The extract is used as a pill excipient; the liquid preparations are bitter tonics, but are not so useful as many other bitter preparations.

Prepared from the **fresh** root.

**Extractum Taraxaci**.—A fresh extract.

*Dose*.—5 to 15 grains.

**Succus Taraxaci**.—The juice to which one-third its volume of alcohol (90 per cent.) has been added.

*Dose*.—1 to 2 fluid drachms.

Prepared from the **dried** root.

**Extractum Taraxaci Liquidum**.—Contains the active principles of 1 ounce of dandelion root in 1 fluid ounce.

It is liable to deposit a residue on keeping.

*Dose*.— $\frac{1}{2}$  to 2 fluid drachms.

## DRUGS WHICH OWE THEIR ACTIVITY TO A VOLATILE OIL

THE members of this class are fairly numerous. They possess, however, in virtue of the volatile oil they contain, certain common pharmacological actions, and consequently may be regarded as forming a pharmacological group. In many cases (the oils of cinnamon, coriander, caraway, nutmeg, &c.) the action is so nearly identical that it is often immaterial which is employed in therapeutics. On the other hand, some oils possess one or more of the common actions to a greater degree than the majority, or are wanting in aroma or some other quality, so that they find different applications. In large doses some volatile oils are more poisonous than others, and produce somewhat different general symptoms; but as they are rarely used, except in small doses, these symptoms need not be described.

The differences in action of the volatile oils are due to differences in chemical composition. This is often very complex, some oils being mixtures of a large number of substances. The more important constituents are given under each drug.

Oil of Chamomile has been described (page 464). Oil of Copaiba and Oil of Cubebs are described under Copaiba and Cubebs (pages 522 and 523).

*Pharmacological Action of a Volatile Oil.*—It is antiseptic, and stimulant or irritant according to the strength or dose. If rubbed into the skin, it produces redness and slight burning pain, followed in most cases by slightly diminished sensibility, and, if applied for any length of time, causes vesication and even more severe effects. It has a hot, burning taste, and produces marked salivation. The latter effect is most pronounced in the case of oils possessing a pleasant

odour and aromatic taste. These also reflexly increase gastric secretion and stimulate the appetite. On reaching the stomach, a volatile oil, in moderate doses, stimulates the gastric mucous membrane, and produces a feeling of warmth in the epigastrium, probably increases gastric secretion, and reflexly stimulates the heart. The movements of the stomach are regulated, and pain (of flatulence, &c.), if present, is relieved (carminative effect). A similar carminative action occurs in the intestine, and volatile oils are consequently generally administered with purgatives to prevent their griping action. The volatile oil is absorbed and is excreted (the terpene constituents in combination with glycuronic acid) by the kidneys, and, to a less extent, by the bronchial mucous membrane and other organs. During excretion the kidneys are stimulated, and a diuretic action results; and the bronchial mucous membrane, if relaxed, is stimulated, and excessive bronchial secretion, if present, diminished. The excreted products make the urine somewhat antiseptic, and during the passage of the urine they stimulate the mucous membrane of the urinary tract. Most of the volatile oils, oil of cinnamon more especially, cause an increased leucocytosis in the blood.

If the oils are administered in larger doses, symptoms of irritation of the kidneys (lumbar pain, &c.) and of the urinary tract are produced, and still larger doses cause gastro-enteritis.

Therapeutically, the volatile oils are used externally as antiseptic and antiparasitic agents in skin diseases, as cutaneous irritants (oil of turpentine especially), and as perfumes for lotions, ointments, &c. Internally, the majority are employed as flavouring and carminative agents, a few as expectorants, and some as diuretic remedies.

*Umbelliferous Fruits.*—Some of the drugs belonging to this group are umbelliferous fruits, the pharmacopœial description of which is a frequent source of trouble to students. Hence a short general description is inserted here. The fruit is known as a cremocarp (fig. 92, *a* and *b*), and is

divisible into two distinct halves, called mericarps. Each mericarp is marked by a certain number of more or less prominent ridges, which are divided into primary and secondary ridges. Primary ridges (*p*) are those containing a fibro-vascular bundle (marked by a dot in the diagrams, figs. 92 to 97). Secondary ridges contain no fibro-vascular bundle, and are not usually present, but, as in the case of coriander fruit,

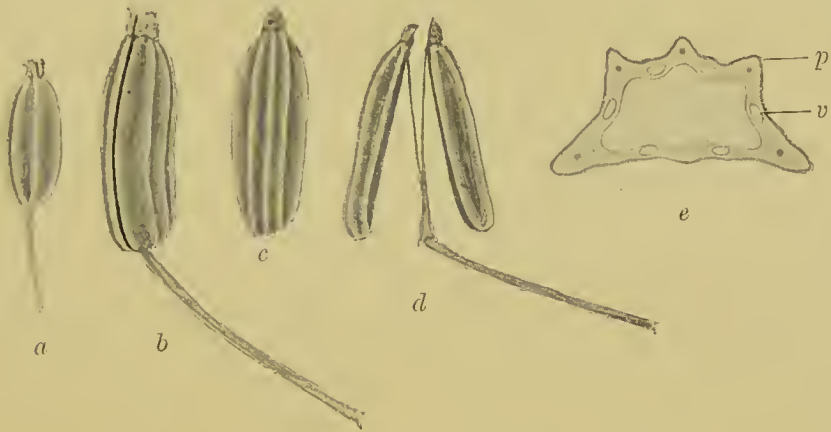


FIG. 92.

Fennel fruit: (*a*) and (*b*), whole cremocarps; (*c*) dorsal view of mericarp, showing ridges; (*d*) cremocarp separated into mericarps; (*e*) diagrammatic section of mericarp; (*p*) primary ridge with fibro-vascular bundle; (*v*) vitta (oil-gland).  $\frac{2}{3}$  linear. (*e*)  $\frac{12}{1}$  linear.

may be the more prominent of the two. The volatile oil is secreted in oil-glands or vittæ, which run longitudinally along the fruit, and are always found on the commissural surface and (one) generally between the fibro-vascular bundles. Their distribution is shown in the diagrams as oval spaces (*v*).

#### CORIANDER FRUIT

**Coriandri Fructus.**—‘The dried ripe fruit of *Coriandrum sativum*, *Linn.*’

*Characters.*—Almost globular fruits, brownish-yellow in colour, glabrous, and about  $\frac{1}{16}$  inch in diameter. The two mericarps are firmly united, and are crowned by the remains of the calyx teeth and stylopod. Each mericarp shows five wavy, primary ridges, alternating with four secondary, more



distinct, and straight ridges. On transverse section, two vittæ are seen on the commissural surface of each mericarp;

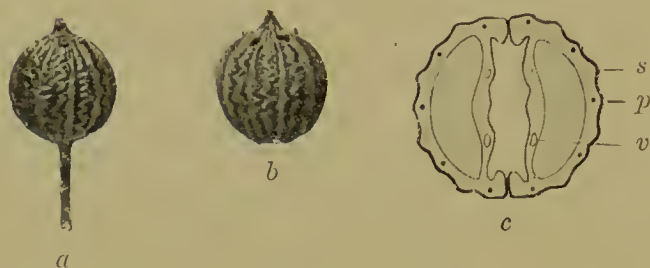


FIG. 93.

Coriander fruit. (a) and (b), whole fruits, (a) showing stalk which is occasionally present; (c) diagrammatic section of fruit; (p) primary ridge (with fibro-vascular bundle); (s) secondary ridge; (v) vitta (oil-gland). (a) and (b)  $\frac{3}{4}$  linear; (c)  $\frac{1\frac{1}{2}}{1}$  linear.

the endosperm is broadly crescentic. The odour and taste are aromatic; the odour becomes more marked when the fruit is bruised.

*Active Principle.*—The official **volatile oil** (nearly 1 per cent.).

It consists chiefly of *d*-pinene and *d*-linalool.

*Pharmacology.*—It is a carminative and flavouring agent, and is employed solely as such.

It is used in the preparation of **Confectio Sennæ**, **Tinctura Sennæ Composita**, **Syrupus Rhei**, **Tinctura Rhei Composita**.

**Oleum Coriandri.**—‘The oil distilled from coriander fruit.’

*Characters.*—Colourless or pale yellow, with the characteristic odour and taste of the fruit.

Specific gravity, 0.870 to 0.885. It should contain no oil of turpentine or added terpenes.

It is contained in **Syrupus Sennæ**.

*Dose.*— $\frac{1}{2}$  to 3 minims.

## CARAWAY FRUIT

**Carui Fructus.**—‘The dried fruit of *Carum Carvi*, Linn.’

*Characters.*—The mericarps are usually separate. Each mericarp is slightly curved and tapers towards each end, is about  $\frac{1}{6}$  to  $\frac{1}{4}$  inch long and  $\frac{1}{25}$  inch broad, brown in colour, and has five yellow primary ridges running the whole length of

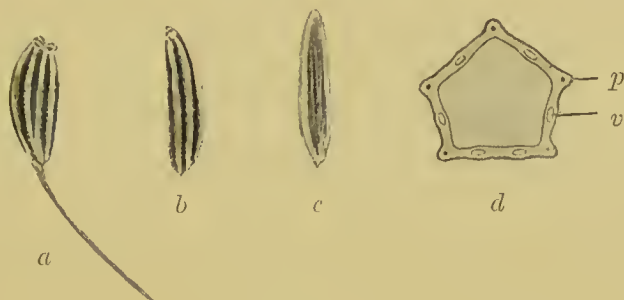


FIG. 94.

Caraway fruit; (a) whole fruit; (b) dorsal, (c) commissural surface of a mericarp; (d) diagrammatic section of a mericarp; (p) primary ridge; (v) vitta (oil-gland). (a), (b), (c)  $\frac{3}{4}$  linear; (d)  $\frac{12}{11}$  linear.

the fruit. On section, six vittæ (four dorsal, two commissural) can be seen with a powerful lens. The odour and taste are aromatic and characteristic.

*Active Principle.*—The official **volatile oil** (about 5 per cent.).

It consists chiefly of *d*-carvone, and, to a less extent, of *d*-limonene. It contains also dimethyl-diketone and other compounds.

The fruit contains a little tannin, resin, and unimportant substances. It should not yield more than 8 per cent. of ash.

*Pharmacology.*—It is used solely as a carminative and a flavouring agent.

**Aqua Carui.**—Contains the volatile oil of 1 ounce of caraway in 10 fluid ounces.

It appears to contain traces of furfural and methyl alcohol.

**Oleum Carui.**—‘The oil distilled from caraway fruit.’

*Characters.*—Colourless or pale yellow, with the characteristic odour and taste of the fruit.

Specific gravity, 0.910 to 0.920.

*Dose.*— $\frac{1}{2}$  to 3 minims.

It is a constituent of **Pilula Aloes Barbadensis**.

Caraway fruit is used in preparing **Confectio Piperis**, **Pulvis Opii Compositus**, **Tinctura Cardamomi Composita**, **Tinctura Sennæ Composita**.

### DILL FRUIT

**Anethi Fructus.**—‘The dried ripe fruit of *Peucedanum graveolens*, *Benth. and Hook. f.*’

*Characters.*—The mericarps are usually separate. Each mericarp has a flattened appearance, is oval or broadly oval in shape, brown in colour, glabrous, and about  $\frac{1}{6}$  inch long and  $\frac{1}{10}$  inch broad. There are five primary ridges, the three dorsal being inconspicuous, the lateral being extended into

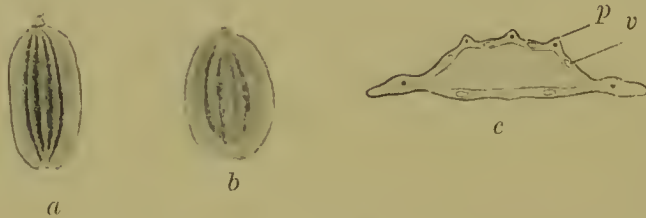


FIG. 95.

Dill fruit: (a) dorsal, (b) commissural surface of a mericarp; (c) diagrammatic section showing (p) primary ridges, (v) vittæ. (a) and (b),  $\frac{3}{4}$  linear; (c)  $\frac{12}{1}$  linear.

well-marked wings. Examined microscopically, the section shows six vittæ (four dorsal, two commissural). The odour and taste are aromatic and characteristic.

*Active Principle.*—The official **volatile oil** (about 3 or 4 per cent.).

Its composition is similar to that of Oil of Caraway.

*Pharmacology.*—Its action is the same as that of caraway fruit.

**Aqua Anethi.**—Contains the volatile oil of 1 ounce of dill fruit in 10 fluid ounces.

**Pharmacology.**—It is the water commonly used for flatulence and colic in children.

**Oleum Anethi.**—‘The oil distilled from dill fruit.’

**Characters.**—Pale yellow, with the odour and taste of the fruit.

Specific gravity, 0·905 to 0·920. It should have an optical rotation of not less than 70° to the right, at 15·5°C.

**Dose.**— $\frac{1}{2}$  to 3 minims.

#### FENNEL FRUIT

**Fœniculi Fructus.**—‘The dried ripe fruit of *Fœniculum capillaceum*, *Gilib.*, collected from cultivated plants.’

**Characters.**—The mericarps are generally united, but are easily separated. The fruit is greenish-brown or yellowish-

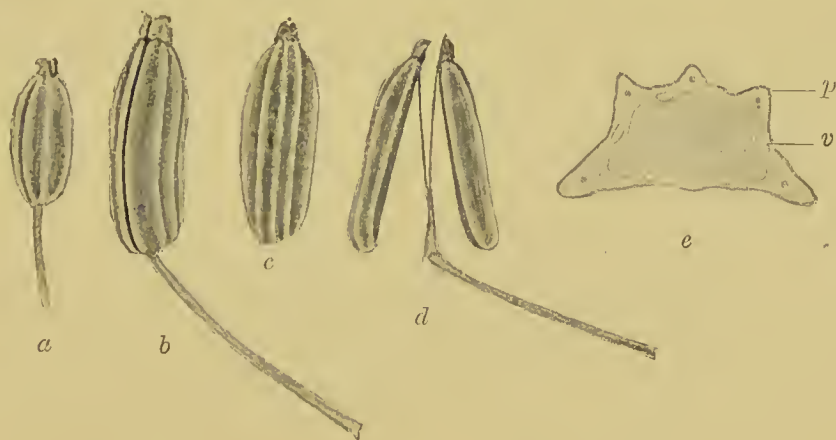


FIG. 96.

Fennel fruit: (a) and (b) are different varieties; (c) dorsal surface of mericarp, showing ridges; (d) fruit separated into two mericarps; (e) diagrammatic section of mericarp, showing primary ridges (*p*) and vittæ (*v*). (a), (b), (c), (d),  $\frac{3}{4}$  linear; (e)  $\frac{12}{1}$  linear.

brown in colour, glabrous, more or less curved, and varies in size in the different varieties from  $\frac{1}{5}$  to  $\frac{2}{5}$  inch long and  $\frac{1}{12}$  to  $\frac{1}{8}$  inch broad. It is crowned by a conspicuous stylopod and



two styles, and the pedicel is usually present. Each mericarp has five primary ridges, the two lateral being very prominent; and on section shows six vittæ (four dorsal, two commissural). The odour and taste are aromatic and characteristic.

*Active Principle.*—A **volatile oil** (2 to 5 per cent.).

It consists mainly of fenchone and anethol, the proportions varying to some extent reciprocally, in different varieties of oil. *d*-Pinene and other terpenes are usually present.

Fenchone ( $C_{10}H_{16}O$ ) is an isomer of camphor, and has a somewhat bitter, pungent, camphoraceous taste.

*Pharmacology.*—It is a useful carminative, but is not a favourite flavouring agent. It is used largely in veterinary practice.

**Aqua Fœniculi.**—Contains the volatile oil of 1 ounce of fennel fruit in 10 fluid ounces.

**Pulvis Glycyrrhizæ Compositus.**—Contains 1 of fennel fruit in 12. See page 403.

It is the carminative agent in this preparation.

#### ANISE FRUIT

**Anisi Fructus.**—‘The dried ripe fruit of *Pimpinella Anisum*, *Linn.*’



FIG. 97.

Anise fruit: (a) whole fruit; (b) dorsal, (c) commissural surface; (d) diagrammatic section of fruit, showing ridges, hairs, and numerous vittæ. The vittæ on the commissural surfaces are not shown. (a), (b), (c),  $\frac{3}{4}$  linear; (d)  $\frac{1}{2}$  linear.

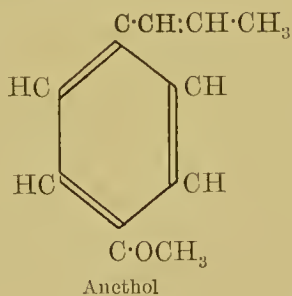
*Characters.*—The mericarps are generally united. The fruit is somewhat pear-shaped, but laterally compressed and

surmounted by a stylopod and two divergent styles; it is about  $\frac{1}{5}$  inch long and  $\frac{1}{12}$  inch broad, greyish-brown in colour, and rough, owing to the presence of bristly hairs. The pedicel is usually attached. Each mericarp shows five inconspicuous primary ridges, and when examined microscopically a section shows numerous vittæ. The odour and taste are agreeably aromatic and characteristic.

Anise fruit somewhat resembles Hemlock Fruit (page 286), but is easily distinguished from it by its characteristic odour and taste. Examined under a lens, anise fruit is seen to be hairy, and the ridges are straight; hemlock fruit is not hairy, and the ridges are crenated. On section, the endosperm of hemlock fruit on the commissural side is seen to be grooved, and microscopically examined it shows no vittæ, whereas anise fruit shows numerous (thirty to forty) vittæ.

*Active Principle.*—The official **volatile oil** (2 to 5 per cent.).

It consists mainly of anethol (up to 90 per cent.), which separates as colourless crystals on cooling the oil.



It also contains methyl-chavicol, an isomer of anethol, anisic aldehyde, anisic acid, and a terpene.

An oil almost identical in composition is obtained from the fruit of the star-anise. Most of the anise oil of commerce is prepared from this.

*Pharmacology.*—It is a carminative and flavouring agent, and is largely used for flavouring cough medicines. It has a mild stimulant action on the bronchial mucous membrane.

**Aqua Anisi.**—Contains the volatile oil of 1 ounce of anise fruit in 10 fluid ounces.

**Oleum Anisi.**—‘The oil distilled from anise fruit, or from the fruit of the star-anise, *Illicium verum*, *Hook. fil.*’

*Characters.*—Colourless or pale yellow, with the odour and taste of the fruit. It congeals between 10° and 15°C. if stirred.

Good samples again become liquid between 18° and 20°C.; the Pharmacopœia gives 15°C. as the minimum limit. Specific gravity (at 20°C.), 0.975 to 0.990. It is slightly lævo-rotatory.

*Dose.*— $\frac{1}{2}$  to 3 minims.

**Spiritus Anisi.**—Contains 1 of oil of anise in 10 by volume.

Oil of anise, 1 fl. oz.; alcohol (90 per cent.), to make 10 fl. oz.

*Dose.*—5 to 20 minims.

It is a convenient solution for prescribing oil of anise in mixtures.

Oil of anise is present in **Tinctura Camphoræ Composita** (page 315) and **Tinctura Opii Ammoniata** (page 315).

#### CINNAMON BARK

**Cinnamomi Cortex.**—‘The dried inner bark of shoots from the truncated stocks of *Cinnamomum zeylanicum*, *Breyn.* Obtained from cultivated trees. Imported from Ceylon, and distinguished in commerce as Ceylon cinnamon.’

*Characters.*—Long, slender, closely rolled, composite quills, often a yard or more in length, and from  $\frac{1}{4}$  to  $\frac{3}{8}$  inch in thickness, consisting of quills a few inches in length invagi-



FIG. 98.

Cinnamon bark, showing composite character of quills, and wavy lines on external surface.  $\frac{1}{2}$  linear.

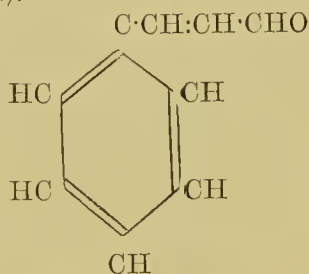
nated into one another, and containing smaller quills or channelled pieces. Each quilled or channelled piece is of papery thickness, brittle, of a dull, light yellowish-brown colour externally, and marked by paler wavy lines and by small holes or scars. The inner surface is darker in colour,

and finely striated longitudinally. The fracture is splintery. The odour and taste are aromatic and characteristic.

Inferior varieties (not official) are usually thicker and larger in size and often show patches of adhering cork. Cassia bark (not official) is larger and thicker, usually shows adhering cork, and occurs in single quills of an earthy-brown colour externally. The fracture is short, not splintery. The taste is less aromatic and more astringent.

*Active Principles.*—The official **volatile oil** (0·5 to 1 per cent.); tannin.

The oil consists of cinnamic aldehyde (about 70 to 80 per cent.), cinnamic acid (produced from the aldehyde by oxidation, and increasing with the age of the oil), benzaldehyde, eugenol (about 8 per cent.), terpenes (phellandrene, &c.).



Cinnamic Aldehyde

*Pharmacology.*—On account of its delicate aroma it is largely used as a flavouring agent. The powdered bark is mildly astringent on account of the tannic acid it contains, and is sometimes employed, alone or in combination with other remedies, in the treatment of diarrhoea. The oil appears to cause a more decided leucocytosis than most other volatile oils.

**Aqua Cinnamomi.**—Contains the volatile oil of 1 ounce of cinnamon bark in 10 fluid ounces. It has a turbid appearance, but is often filtered.

*Pharmacology.*—It is one of the most commonly used excipients for mixtures. Sweetened, it is a valuable remedy in the treatment of colicky pains in babies, and is often more readily taken than dill water.

It is an ingredient of four official mixtures—**Mistura Cretæ**, **Mistura Guaiaci**, **Mistura Olei Ricini**, **Mistura Spiritus Vini Gallici**—and of two syrups—**Syrupus Aromaticus** and **Syrupus Cascaræ Aromaticus**.



**Pulvis Cinnamomi Compositus.**—Consists of cinnamon bark 1, cardamom seeds 1, ginger 1.

It is contained in *Pilula Aloes et Ferri* and *Pilula Cambogiæ Composita*.

*Dose.*—10 to 40 grains.

*Pharmacology.*—It is a powerfully carminative powder, and in virtue of the tannin present in the cinnamon is a mild intestinal astringent. It is useful in mild cases of diarrhœa with much griping, and as a corrective of the griping tendency of some purgatives.

**Tinctura Cinnamomi.**—Contains the active ingredients of 1 ounce of cinnamon bark in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is mainly flavouring and carminative.

Cinnamon bark is used in the preparation of *Decoctum Hæmatoxyli*, *Tinctura Cardamomi Composita*, *Tinctura Catechu*, *Tinctura Lavandulæ Composita*, and is contained in *Pulvis Catechu Compositus*, *Pulvis Cretæ Compositus*, and *Pulvis Kino Compositus*.

**Oleum Cinnamomi.**—‘The oil distilled from cinnamon bark.’

*Characters.*—Yellow, but gradually becoming reddish by keeping, having the odour and taste of the bark.

Specific gravity, 1·025 to 1·035. It should contain at least 50 per cent. of substances of an aldehydic nature and no cinnamon-leaf oil.

*Dose.*— $\frac{1}{2}$  to 3 minims.

**Spiritus Cinnamomi.**—Contains 1 of oil of cinnamon in 10 by volume.

Oil of cinnamon, 1 fl. oz.; alcohol (90 per cent.), to make 10 fl. oz.

It is contained in *Acidum Sulphuricum Aromaticum*.

*Dose.*—5 to 20 minims.

## NUTMEG

**Myristica.**—‘The dried seed of *Myristica fragrans*, *Houtt.*, divested of its testa.’

The tree produces a fruit somewhat resembling a peach, which, when split longitudinally, exhibits a crimson reticulated arillus (mace) surrounding a brown shining seed. After drying, the testa of the seed is removed and the kernel (nutmeg) collected.

*Characters.*—Greyish-brown ovoid seeds, about 1 inch long and  $\frac{3}{4}$  to  $\frac{7}{8}$  inch broad, marked with shallow reticulated furrows. It has a hard, waxy consistence, and is readily cut in thin slices. The section shows broad, brownish-red, wavy



FIG. 99.

Nutmeg: (a) whole seed; (b) horizontal, (c) vertical section, showing arrangement of brownish-red wavy lines. Natural size.

lines, radiately arranged in transverse section, with pale greyish-brown interspaces. The odour is aromatic and characteristic; the taste aromatic and somewhat bitter.

*Active Principle.*—The official **volatile oil** (8 to 15 per cent.).

It consists mainly of *d*- and *l*-pinene, but contains myristicol and other substances.

Nutmeg contains about 30 per cent. of fat, consisting chiefly of glyceryl myristate.

*Pharmacology.*—It is a useful carminative and flavouring agent. Large quantities (1 nutmeg powdered) produce a severe intoxication, and not infrequently delirium and coma.

It is used in the preparation of *Spiritus Armoracæ Compositus* and *Tinctura Lavandulæ Composita*, and is contained in *Pulvis Catechu Compositus* and *Pulvis Cretæ Aromaticus*.

**Oleum Myristicæ.**—‘The oil distilled from nutmeg.’

*Characters.*—Colourless or pale yellow, with the odour and taste of nutmeg.

Specific gravity, 0·870 to 0·910. It should not contain any of the fatty oil of nutmeg.

*Dose.*— $\frac{1}{2}$  to 3 minims.

**Spiritus Myristicæ.**—Contains 1 of oil of nutmeg in 10 by volume.

Oil of nutmeg, 1 fl. oz.; alcohol (90 per cent.), to produce 10 fl. oz.

*Dose.*—5 to 20 minims.

It is contained in **Mistura Ferri Composita**.

Oil of nutmeg is an ingredient of **Pilula Aloes Socotrinæ**, **Spiritus Ammoniæ Aromaticus**, **Tinctura Guaiaci Ammoniata**, **Tinctura Valerianæ Ammoniata**.

## PIMENTO

**Pimenta**—allspice. ‘The dried full-grown unripe fruit of *Pimenta officinalis*, *Lindl.*’

*Characters.*—Dark reddish-brown, rough, nearly globular fruits, crowned by a raised ring (the remains of a four-toothed calyx), enclosing the remains of the style; from  $\frac{1}{5}$  to  $\frac{1}{3}$  inch in

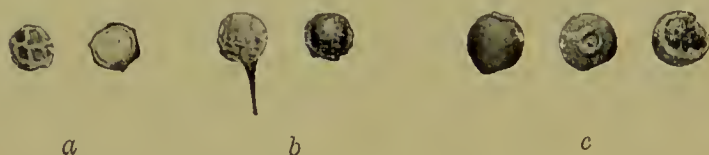


FIG. 100.

(c) Pimento, showing whole fruits with raised ring (remains of calyx); and section showing two cells, each containing a seed. (a) Pepper; (b) Cubebs. Natural size.

diameter. The pericarp is brittle. On section the fruit is seen to be two-celled, each cell containing a brownish-black, somewhat reniform seed. The odour and taste are aromatic and characteristic.

Cubebs (page 522) is reticulated on the surface, is stalked, and contains only a single seed. Black pepper (page 288) is reticulated on

the surface, and one-celled, but is not stalked. The taste of the three drugs is different.

*Active Principles.*—The official **volatile oil** (3 to 4.5 per cent.); tannin.

The oil consists mainly of eugenol (65 per cent. or more ; see page 484), but contains also a sesquiterpene and other compounds.

*Pharmacology.*—It is strongly aromatic and a powerful carminative. Its action is similar to, but somewhat weaker than, that of cloves. It is not very largely used.

**Aqua Pimentæ.**—Contains the volatile oil of  $\frac{1}{2}$  ounce of pimento in 10 fluid ounces.

**Oleum Pimentæ.**—‘The oil distilled from pimento.’

*Characters.*—Yellow or yellowish-red, but gradually becoming darker by keeping, with the odour and taste of pimento.

Specific gravity, 1.040 to 1.055. Owing to the presence of eugenol, it should give the tests mentioned under Oil of Cloves.

*Dose.*— $\frac{1}{2}$  to 3 minims.

## CLOVES

**Caryophyllum.**—‘The dried flower-buds of *Eugenia caryophyllata*, *Thunb.*’

*Characters.*—Consists of a dark reddish-brown, somewhat flattened, angular and pitted portion (the so-called calyx tube), surmounted by four thick patent teeth, which appear to support a paler, almost globular, flower-head. This consists of four petals enclosing numerous stamens and a stiff erect style, which can readily be seen on making a longitudinal section. The section also shows the two-celled ovary just below the level of the teeth, and numerous oil-glands in the wall of the lower tubular portion. When



FIG. 101.

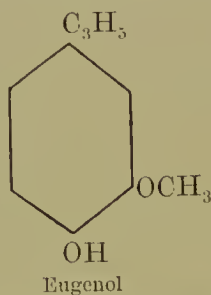
Cloves: (a) whole clove ; (b) longitudinal section, showing (indistinctly) numerous stamens, style, ovary, and oil-glands. Natural size.



this portion is indented with the finger-nail, oil should exude, showing that it is not a 'spent' clove. The odour and taste are strongly aromatic and characteristic.

*Active Principles.*—The official **volatile oil** (15 to 20 per cent.) ; tannin (about 10 per cent.).

The oil consists almost solely of eugenol (80 to 95 per cent.) and caryophyllene (a sesquiterpene). Traces of other substances—furfurol, methyl-amyl - ketone, methyl - nonyl - ketone, acetyl - eugenol, &c. — are present.



Cloves also contain caryophyllin, a colourless, odourless, crystalline substance, and eugenin.

*Pharmacology.*—It has the characteristic action of other members of this group, but the action of the oil approaches that of carbolic acid more closely than do other volatile oils. Thus it is a more powerful local anodyne, and is commonly used to stop the pain of a hollow aching tooth. This relation to carbolic acid is due to the fact that oil of cloves consists almost wholly of a phenol (eugenol).

**Infusum Caryophylli.**—Contains the active ingredients of  $\frac{1}{2}$  ounce of cloves in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—It is carminative and slightly astringent, and is a useful flavouring agent for some medicines. It is also mildly antiseptic, and tends to diminish gastric fermentation.

Cloves are used in the preparation of **Infusum Aurantii Compositum**, and are a constituent of **Pulvis Cretæ Aromaticus**.

**Oleum Caryophylli.**—'The oil distilled from cloves.'

*Characters.*—Colourless or pale yellow, but gradually becoming reddish-brown by keeping, with the odour and taste of cloves.

Specific gravity, 1·050 to 1·070. Owing to the eugenol it contains, the oil, when shaken with an equal volume of strong solution of ammonia, forms a semi-solid mass; an alcoholic solution also gives, with solution of ferric chloride, a blue colour.

Dose.— $\frac{1}{2}$  to 3 minims.

It is contained in *Pilula Colocynthis Composita*, and therefore also in *Pilula Colocynthis et Hyoscyami*.

### CARDAMOM SEEDS

The seeds retain their aromatic properties best if kept in the fruit; hence the Pharmacopœia states that they 'should be kept in their pericarps and separated when required for use.'

**Cardamomi Semina.**—'The dried ripe seeds of *Elettaria Cardamomum*, *Maton*.'

*Characters.*—The fruits vary in shape and size, the smaller, about  $\frac{2}{5}$  inch long, being almost globular, the larger, about  $\frac{1}{5}$  inch long, being elongated and bluntly triangular in section. They have a plump appearance, a pale-buff colour,

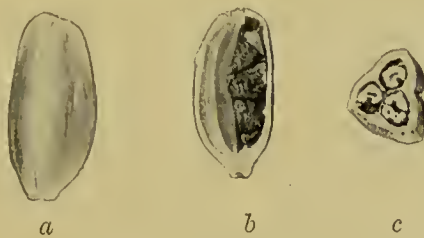


FIG. 102.

Cardamom fruit: (a) whole fruit; (b) longitudinal section, showing wall of a cell and seeds in position; (c) transverse section. The fruits are inverted. Natural size.

and are usually longitudinally striated. They taper abruptly near the apex, and sometimes terminate in a short beak formed by the remains of the calyx; the base is rounded and is occasionally attached to the stalk. The fruit is three-celled, each cell containing a double row of seeds.

The seeds are about  $\frac{1}{8}$  inch in diameter, irregularly angular, transversely wrinkled, and reddish-brown in colour.

They are enclosed in a thin, colourless, membranous aril. They have a pleasant aromatic odour and taste. (The pericarp is odourless and tasteless.)

*Active Principle*.—A **volatile oil** (4 to 5 per cent.).

It consists of terpinene, terpineol, and limonene, or, possibly, dipentene.

The seeds contain also a fixed oil (10 per cent.) and other unimportant ingredients.

*Pharmacology*.—They are flavouring and carminative.

**Tinctura Cardamomi Composita**. — Contains the active ingredients of 1 ounce of aromatic substances (cardamom seeds, caraway fruit, cinnamon bark) in 20 fluid ounces. It is coloured with cochineal.

Cardamom seeds,  $\frac{1}{4}$  oz.; caraway fruit,  $\frac{1}{4}$  oz.; raisins of commerce, freed from seeds, 2 oz.; cinnamon bark,  $\frac{1}{2}$  oz.; cochineal, 55 grains; alcohol (60 per cent.), 20 fl. oz.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—It is a useful flavouring, carminative, and colouring preparation. It is used largely as a carminative, combined with other remedies, in diseases of the stomach and intestines.

It is contained in **Decoctum Aloes Compositum** and **Mistura Sennæ Composita**.

Cardamom seeds are used in preparing **Tinctura Gentianæ Composita** and **Tinctura Rhei Composita**, and are contained in **Extractum Colocynthis Compositum**, **Pulvis Cinnamomi Compositus**, and **Pulvis Cretæ Aromaticus**.

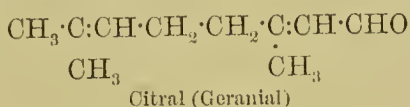
## LEMON PEEL

**Limonis Cortex**.—‘The fresh outer part of the pericarp of the fruit of *Citrus medica*, *Linnaeus*, var.  $\beta$  *Limonum*, *Hook. f.*’

*Characters*.—The appearance of the lemon needs no description. The peel for pharmacopœial purposes should contain as little of the white inner portion (zest) as possible. The taste is aromatic and somewhat bitter.

*Active Principle.*—The official **volatile oil**.

It consists mainly of *d*- and *l*-limonenes. The characteristic odour is due to oxygenated compounds, of which citral (geranial, 5 to 6 per cent.) is the chief.



Other constituents are citronellal, geraniol, and geranyl acetate. The zest contains the glucoside hesperidin (see page 462).

*Pharmacology.*—It is used mainly as a flavouring agent. The oil is also employed to perfume applications for external use.

**Tinctura Limonis.**—Contains the volatile oil of 1 ounce of fresh lemon peel in 4 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

Fresh lemon peel is used in preparing **Syrupus Limonis**, **Infusum Aurantii Compositum**, and **Infusum Gentianæ Compositum**.

**Oleum Limonis.**—‘The oil obtained from fresh lemon peel.’

*Characters.*—Pale yellow, with the odour and taste of fresh lemon peel.

Specific gravity, 0.857 to 0.860. It is liable to be adulterated with terpenes, alcohol, and other substances. The Pharmacopœia gives the optical rotation as a test of its purity, but it appears to be of doubtful value in all circumstances.

*Dose.*— $\frac{1}{2}$  to 3 minims.

The oil is a constituent of **Linimentum Potassii Iodidi cum Sapone**, **Spiritus Ammoniæ Aromaticus**, **Tinctura Guaiaci Ammoniata**, and **Tinctura Valerianæ Ammoniata**.

**Succus Limonis.**—‘The freshly expressed juice of the ripe fruit of *Citrus medica*, *Linn.*, var. *β Limonum*, *Hook. fil.*’

*Characters.*—A slightly turbid, somewhat yellowish liquid, with a characteristic strongly acid taste. Each fluid ounce contains from 30 to 40 grains of citric acid.

Specific gravity, 1.030 to 1.040. It should not yield more than 3 per cent. of ash. It is liable to ferment, and consequently cannot be kept for long.



*Chief Constituent.*—**Citric acid** (about 8 per cent.).

It also contains a small quantity of the volatile oil, and small amounts of sugar, gum, potassium and calcium salts, phosphates, &c.

*Pharmacology.*—Its action is due mainly to the citric acid it contains (see page 70). It forms, when sweetened, a pleasant beverage for febrile patients. It is also used to prevent scurvy, and is sometimes given in acute rheumatism.

**Syrupus Limonis.**—Lemon juice saturated with sugar and containing a little of a strong tincture of lemon peel.

Fresh lemon peel, 1 oz., extracted with sufficient alcohol (90 per cent.) to make 2 fl. oz.; lemon juice (clarified), 25 fl. oz.; sugar, 38 oz. The product should weigh 4 lbs. 1 oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is a useful flavouring syrup, but is used, chiefly diluted with water, as a beverage.

#### ELDER FLOWERS

**Sambuci Flores.**—‘The flowers of *Sambucus nigra*, Linn., separated from the stalks.’

*Characters.*—Very small flowers with a 5-lobed, creamy-white monopetalous corolla and 5 short stamens with yellow anthers. They have a faint odour and a slightly bitter taste.

The inflorescence is an umbellate cyme. The entire flower has a small, green, 5-toothed, superior calyx, but this is usually absent in the dried flower.

The flowers are separated from the stalks by throwing them into a heap for some hours and then sifting. If not used fresh they are dried, or preserved (‘pickled’) by the addition of common salt. The somewhat unpleasant odour of the fresh flowers is said to disappear in the process of pickling.

The dried flowers usually contain short pieces of stalk, and sometimes an intact part of the inflorescence (fig. 104).



FIG. 103.

Dried elder flowers.  $\frac{3}{1}$  linear.

*Active Principle.*—A **volatile oil** (small quantities).

It is a yellowish solid at ordinary temperatures. The fresh flowers yield 0.03 to 0.04 per cent. and the dried flowers about 0.0025 per cent. of the oil.



FIG. 104.

A dried portion of the inflorescence found in the commercial drug.  
Natural size.

*Pharmacology.*—It has no important pharmacological action. It is only used as the water, which is employed as an excipient for lotions and similar preparations.

**Aqua Sambuci.**—Contains the volatile oil of 1 ounce of elder flowers in 1 fluid ounce.

It also contains traces of ammonia.

## RED-ROSE PETALS

**Rosæ Gallicæ Petala.**—‘The fresh and dried unexpanded petals of *Rosa gallica*, *Linn.* From cultivated plants.’

*Characters.*—Small cone-shaped masses or separate obovate petals, velvety, deep purplish-red passing into brownish-yellow at the base, with a characteristic fragrant odour and a slightly bitter astringent taste. The dried petals have a more delicate aroma than the fresh petals.

*Chief Constituents.*—A volatile oil (to which the aroma is due; very small quantities); a red and a yellow colouring substance; tannic and gallic acids (very small quantities).

*Pharmacology.*—It is mildly astringent, but is used mainly as a flavouring and colouring agent.

Prepared from the **fresh** petals.

**Confectio Rosæ Gallicæ.**—Consists of fresh red-rose petals 1, sugar 3.

*Pharmacology.*—It is used as a pill excipient.

It is so used in *Pilula Aloes Barbadensis*, *Pilula Aloes Soeotrinæ*, *Pilula Aloes et Asafetidæ*, *Pilula Hydrargyri*.

Prepared from the **dried** petals.

**Infusum Rosæ Acidum.**

Red-rose petals,  $\frac{1}{2}$  oz.; diluted sulphuric acid, 2 fl. dr.; boiling distilled water, 20 fl. oz.

The sulphuric acid gives it a brighter colour and pleasanter taste.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—It has a mild astringent action due mainly to the sulphuric acid. It is used chiefly as an excipient.

**Syrupus Rosæ.**

Dried red-rose petals, 2 oz.; sugar, 30 oz.; boiling distilled water, 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is used as a colouring and flavouring syrup.

## VALERIAN RHIZOME

**Valerianæ Rhizoma.**—‘The dried erect rhizome and roots of *Valeriana officinalis*, *Linn.* Collected in the autumn.’

*Characters.*—The rhizome is short, stout, firm, and erect, up to 1 inch long and  $\frac{1}{2}$  inch broad, of a dark yellowish-



FIG. 105.

Valerian rhizome and roots. The rhizome has been divided longitudinally.  
Natural size.

brown colour, and in the larger pieces frequently divided longitudinally. It is often crowned by the remains of the stem and leaves, and gives off a large number of long, brittle roots, 3 to 4 inches in length and about  $\frac{1}{16}$  inch in thickness, of the same colour as the rhizome, and slightly striated longitudinally but not much shrivelled. The undivided rhizome is generally surrounded by them. The characteristic unpleasant odour is developed mainly during the process of drying. The taste is slightly bitter and camphoraceous.



Small rhizomes have some resemblance to serpentry rhizome, but are easily distinguished by their characteristic odour. The roots of serpentry are also slenderer, and the rhizome shows ascending branches.

*Active Principle*.—A **volatile oil** (0·5 to 1 per cent.) which contains free isovalerianic acid.

The oil consists of terpenes (pinene, camphene, &c.), terpene alcohols (terpineol, &c.), and borneol and its esters (acetic, butyric, isovalerianic). Bornyl isovalerianate gradually decomposes, yielding isovalerianic acid to which the unpleasant characteristic odour of the dried drug is due.

The drug also contains tannin and resinous matter, and, it is said, two alkaloids (chatinine and valerianine) and a glucoside.

*Pharmacology*.—Its action is due to the volatile oil it contains. It is carminative and is credited with antispasmodic properties. The iso-valerianic acid has no action beyond that produced by its unpleasant smell, which, however, makes this drug very serviceable in the treatment of hysterical conditions.

**Tinctura Valerianæ Ammoniata**.—Contains 1 fluid ounce of solution of ammonia and the active principles of 2 ounces of valerian rhizome in 10 fluid ounces. It also contains a little oil of nutmeg and oil of lemon.

Valerian rhizome, 4 oz. ; oil of nutmeg, 30 minims ; oil of lemon, 20 minims ; solution of ammonia, 2 fl. oz. ; alcohol (60 per cent.), 18 fl. oz.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—Its action is principally that of valerian and of a dilute solution of ammonia. It is used in functional nervous diseases and hysteria, and in flatulence.

## BUCHU LEAVES

**Buchu Folia**.—‘The dried leaves of *Barosma betulina*, *Bart. and Wendl.*’

*Characters*.—Yellowish-green, rhomboid-ovate leaves,  $\frac{1}{2}$  to  $\frac{3}{4}$  inch in length, with a sharply denticulate margin and a blunt, strongly recurved apex ; brittle and rigid when dry, cartilaginous when moist. The surface is glabrous and warty

owing to the presence of oil-glands, which can easily be seen, especially near the margin, by examining the leaf with a lens by transmitted light. The odour and taste are aromatic and characteristic.

Compare with Bearberry Leaves (page 390), which are thicker and more coriaceous in texture, have a spatulate outline, an entire margin, no oil-glands, and an astringent taste.



FIG. 106.

Buchu leaves: (a) under, (b) upper surface. Natural size.

*Active Principle.*—A **volatile oil** (1 to 2 per cent.).

It contains diosphenol (about 30 per cent.), menthone, and a pinene-like substance.

The leaves contain also hesperidin (see page 462), a considerable amount of mucilage, resinous matter, and other unimportant substances.

*Pharmacology.*—This drug has the action common to other members of the group, but is comparatively mild, partly owing to the quantity of mucilage it contains. It has not a pleasant taste and consequently is not a flavouring agent. It is used, mainly in combination with other remedies, for its action on the urinary tract.

**Infusum Buchu.**—Contains the active ingredients of 1 ounce of buchu leaves in 20 fluid ounces.

*Dose.*—1 to 2 fluid ounces.

*Pharmacology.*—It is used as a vehicle in the treatment of subacute and chronic inflammations of the urinary tract (pyelitis, cystitis, &c.).

**Tinctura Buchu.**—Contains the active principle of 1 ounce of buchu leaves in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is used mainly as an auxiliary agent in the treatment of urinary diseases.

## SASSAFRAS ROOT

**Sassafras Radix.**—‘The dried root of *Sassafras officinale*, *T. Nees and Eberm.*’

*Characters.*—Large branched pieces, consisting of a light spongy, greyish-yellow or greyish-red wood, more or less covered with a rough greyish-brown or rusty-brown bark. The odour is faint but agreeably aromatic; the taste is slightly



FIG. 107.

Sassafras root.  $\frac{1}{3}$  linear.

aromatic and astringent. Both odour and taste are most marked in the bark.

*Chief Constituents.*—A **volatile oil** (about 2 per cent.); tannin.

The oil consists mainly of safrol, but also contains terpenes, camphor, and traces of other substances. The tannin appears to undergo oxidation by keeping, being converted into a red substance (sassafrid), which gives the reddish colour to the root.

*Pharmacology.*—It is mildly aromatic and astringent. It is only used as an ingredient of

**Liquor Sarsæ Compositus Concentratus.** See page 379.

#### SUMBUL ROOT

**Sumbul Radix.**—‘The dried transverse slices of the root of *Ferula Sumbul*, *Hook. f.*’

*Characters.*—Very light, almost cylindrical pieces, varying considerably in size, but usually 1 to 3 inches in length and about 1 inch in thickness, marked by large transverse wrinkles. The cork is dusty brown in colour, very thin, but tough and easily separated, and sometimes bearing short

bristly fibres or the scars left by them. The section shows the interior to be of a pale yellowish-brown colour mottled with whiter patches, coarsely and irregularly fibrous, spongy, dry, and showing numerous fissures. The odour is somewhat musk-like; the taste is bitter and slightly aromatic.



FIG. 108.

Sumbul root (from *Ferula suaveolens*), showing transverse wrinkles and characteristic spongy section. Natural size.

*Chief Constituents.*—A **volatile oil** (0·2 to 0·4 per cent.); **resinous matter** (about 9 per cent.) The oil has a musk-like odour.

It also contains a bitter principle, valerianic and other acids, and unimportant substances.

*Pharmacology.*—It is carminative, but has been used chiefly as a stimulant in hysterical conditions.

**Tinctura Sumbul.**—Contains the principles of 1 ounce of sumbul root in 10 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

The following oils are articles of commerce, and are not represented by any crude drug in the Pharmacopœia. Most of them are obtained from the whole or parts of fresh plants.

#### OIL OF PEPPERMINT

**Oleum Menthæ Piperitæ.**—‘The oil distilled from the fresh flowering peppermint, *Mentha piperita*, *Sm.*’

*Characters.*—Colourless to greenish-yellow, but gradually becoming darker by keeping, with a strong penetrating



characteristic odour and taste, the latter being followed by a sensation of coldness in the mouth when air is inhaled.

Specific gravity, 0.900 to 0.920. If cooled in a freezing mixture of ice and salt, and a few crystals of menthol then added, it should set to a semi-solid crystalline mass, owing to the separation of crystals of menthol.

*Chief Constituents.*—**Menthol** (about 60 per cent., see below) ; menthyl acetate and isovalerianate ; menthone.

Menthone is the ketone corresponding to menthol.

Different peppermint oils vary somewhat in composition. The following substances have been isolated : Cineol, certain terpenes (*i*-pinene, eadinene, *l*-limonene, phellandrene), acetic and isovaleric aldehydes and acids, amyl alcohol, dimethyl sulphide.

Oil of white peppermint has the most delicate aroma.

*Dose.*— $\frac{1}{2}$  to 3 minims.

*Pharmacology.*—It is a powerful carminative and flavouring agent. Owing to the menthol it contains, it is more anodyne than other volatile oils, and it causes a sensation of coldness when air is blown over the part to which it has been applied.

It is used largely as a flavouring agent and as a carminative to relieve gastric and intestinal pain. It has been used in place of menthol as a local application for neuralgia, and, in a weak alcoholic solution, as a lotion for itching.

**Aqua Menthæ Piperitæ.**—A 1 in 1,000 solution of oil of peppermint in distilled water.

Oil of peppermint, 77 minims ; water,  $1\frac{1}{2}$  gallons ; distil two-thirds.

**Spiritus Menthæ Piperitæ.**—Contains 1 of oil of peppermint in 10 by volume.

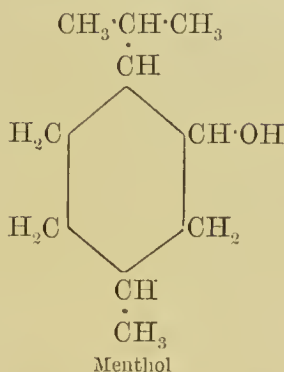
Oil of peppermint, 1 fl. oz. ; alcohol (90 per cent.), to make 10 fl. oz.

*Dose.*—5 to 20 minims.

Oil of peppermint is contained in **Pilula Rhei Composita** and **Tinctura Chloroformi et Morphinæ Composita**.

**Menthol.**—‘ A crystalline substance obtained by cooling the oil distilled from the fresh herb of *Mentha arvensis*, DC.,

vars. *piperascens* et *glabrata*, *Holmes*; and of *Mentha piperita*, *Sm.*'



The oil of *Mentha arvensis* (Japanese oil of peppermint) contains more menthol than the English or American variety.

*Characters*.—Large, colourless, acicular crystals, with the characteristic odour and taste of oil of peppermint. It volatilises completely at 100°C. Slightly soluble in water or glycerin; soluble in less than half its weight of alcohol, ether, or chloroform; and in 4 parts of olive oil.

Melting-point, 42° to 43°C. When added to sulphuric acid diluted with half its volume of water it acquires a brownish colour, which becomes deep violet on boiling the solution, the lower acid layer becoming deep brown.

*Dose*.— $\frac{1}{2}$  to 2 grains.

*Pharmacology*.—Its action is similar to that of oil of peppermint; it also resembles, in some respects, that of camphor. It is antiseptic, carminative, and odorant. When rubbed on the skin it produces a burning sensation, changed to a feeling of cold when the part is blown upon, which is followed by more or less anæsthesia. A similar sensation of warmth, which is changed to cold when air is inhaled, is produced in the mouth. In the stomach it acts as a carminative in small, and as an irritant in large doses, and it has a similar effect in the intestines. It is absorbed, and after large doses produces some excitement and restlessness followed by stupor. It is excreted in combination with glycuronic acid.

It is used almost solely for its local effects. It is rubbed over the area of superficial neuralgia and on the forehead for headache (counter-irritant action). As a lotion in alcohol and

water it is useful in itching (pruritus), and, as an oily solution, is sometimes of value in chronic irritable skin diseases. It is a common ingredient of snuffs for nasal catarrh. A solution has been used as a spray in laryngeal tuberculosis, and a solution in oil has been injected into the trachea in phthisis.

Menthol forms a liquid when triturated with an equal weight of carbolic acid, thymol, or ehloral hydrate, or with about two-thirds its weight of camphor. These mixtures are more powerfully irritant than menthol. They have been employed to paint over an area of neuralgia and as remedies for toothache.

**Emplastrum Menthol.**—A plaster with a resin and wax basis containing  $1\frac{1}{2}$  parts of menthol in 10, by weight.

Menthol,  $1\frac{1}{2}$ ; yellow beeswax, 1; resin,  $7\frac{1}{2}$ .

*Pharmacology.*—It has a mild menthol action, but is little used.

#### OIL OF SPEARMINT

**Oleum Menthæ Viridis.** — ‘The oil distilled from fresh flowering spearmint, *Mentha viridis*, *Linn.*’

*Characters.*—Colourless to greenish-yellow, but becoming darker by keeping. It has a characteristic odour and taste.

Specific gravity, 0.920 to 0.940.

*Chief Constituent.*—Carvone (about 50 per cent.).

*l*-Limonene and *l*-linalool have been isolated; but the oil has not been thoroughly investigated.

*Pharmacology.*—It has the typical action of a volatile oil. It is less powerful than oil of peppermint, and has a different taste and odour. It is not much used in this country.

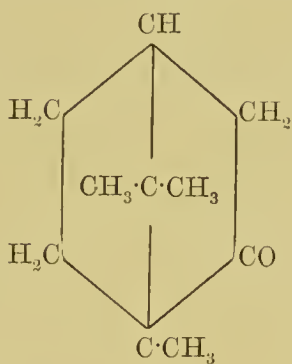
**Aqua Menthæ Viridis.**—A 1 in 1,000 solution of oil of spearmint in distilled water.

Prepared like Aqua Menthæ Piperitæ.

#### CAMPHOR

This, the stearoptene of a volatile oil, is most conveniently considered here.

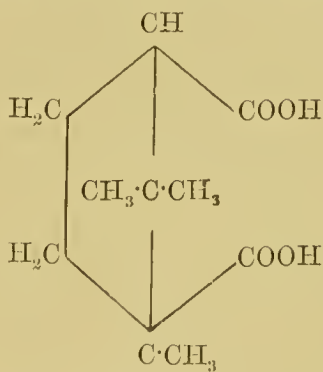
**Camphora.**—‘A white crystalline substance obtained from *Cinnamomum Camphora*, *Nees and Eberm.*, purified by sublimation.’



*Characters.*—Colourless, translucent, crystalline masses, or rectangular tablets, of tough consistence; also as pulverulent masses known as ‘flowers of camphor’; with a characteristic penetrating odour and a characteristic warm bitter taste, changing to a sensation of coolness on inhaling. It sublimes at ordinary temperatures in closed vessels, and readily burns when lit, with a very smoky flame. Soluble in 700 parts of water, in its own weight of alcohol, in less than half its weight of chloroform or ether, in 4 parts of olive oil, and in  $1\frac{1}{2}$  parts of oil of turpentine. When triturated with chloral hydrate, phenol, thymol, menthol, and allied substances, it forms a liquid.

Specific gravity, 0.995. It should sublime completely on gently heating.

Camphor is oxidised by boiling with nitric acid to camphoric acid, which is occasionally used as an anhydrotic, but is not official.



Camphoric Acid



*Dose.*—2 to 5 grains.

*Pharmacology.*—The local action of camphor is similar to that of a volatile oil. Applied to the skin it causes dilatation of the blood-vessels and a feeling of warmth, which is succeeded by diminished sensibility. It is slightly antiseptic. When taken by the mouth in full pharmacopœial doses it has an unpleasant characteristic warm and bitter taste, and acts as a carminative in the stomach and intestines. It is absorbed, and usually produces no other symptoms, but occasionally it causes mild excitement, headache, or giddiness. Large doses (20 grains) may cause gastro-intestinal irritation, but are usually well borne, and after absorption produce a condition resembling mild alcoholic intoxication. Very large doses generally cause convulsions of an epileptic nature, which may be succeeded by coma; but the symptoms observed have been of a variable character. If death does not occur, recovery is rapid.

The effect of camphor on the circulation is ill understood. Small doses stimulate the heart, but whether this is more than a reflex stimulation through the alimentary tract has not been definitely proved. Moderate doses slow the pulse and produce an increase in fulness.

Camphor is excreted in the urine, mainly as  $\alpha$ - and  $\beta$ -campho-glycuronic acids.

It is used externally, chiefly in the form of liniments, for its stimulant and rubefacient effects. It is sometimes given internally for flatulence, and has been recommended as an intestinal antiseptic, and as a remedy, combined with opium, for diarrhœa. It has also been recommended for irritable conditions of the genito-urinary organs, for various nervous affections, and as a cardiac stimulant for the prostration of febrile diseases. Small quantities used as a snuff, or even taken into the mouth, will often temporarily relieve a cold in the head.

**Aqua Camphoræ.**—A 1 in 1,000 solution of camphor in distilled water.

Camphor, 1 gramme; alcohol (90 per cent.), nearly 3 c.c.; distilled water, 1,000 c.c.

*Pharmacology.*—It is used as a flavouring agent and as an auxiliary carminative, expectorant, &c., along with other remedies.

**Spiritus Camphoræ.**—Contains 1 ounce of camphor in 10 fluid ounces.

Camphor, 1 oz.; alcohol (90 per cent.), to produce 10 fl. oz.

*Dose.*—5 to 20 minims.

*Pharmacology.*—It is a convenient solution of camphor for prescribing purposes. It is taken by many people to ward off the effects of a chill, and appears to be efficacious under some conditions.

**Linimentum Camphoræ**—camphorated oil. A solution of 1 ounce of camphor in 4 fluid ounces of olive oil.

*Pharmacology.*—It is a mild cutaneous stimulant. It is used largely as an application to the chest for bronchitis in children. For muscular and joint pains a more powerful liniment is usually preferred. It is sometimes useful for chilblains.

It is a constituent of **Linimentum Chloroformi**, **Linimentum Hydrargyri**, and **Linimentum Terebinthinæ Aceticum**.

**Linimentum Camphoræ Ammoniatum.**—An alcoholic solution containing 1 ounce of camphor and 2 fluid ounces of strong solution of ammonia in 8 fluid ounces.

Camphor,  $2\frac{1}{2}$  oz.; oil of lavender, 1 fl. dr.; strong solution of ammonia, 5 fl. oz.; alcohol (90 per cent.), to produce 20 fl. oz.

*Pharmacology.*—It is a valuable stimulating liniment, useful in the treatment of muscular pains, pain in and around joints, neuralgia, and similar conditions. The ammonia is the most active constituent.

**Tinctura Camphoræ Composita** (see page 315).

Camphor is an ingredient of **Linimentum Aconiti**, **Linimentum Belladonnæ**, **Linimentum Saponis** (and therefore **Linimentum Opii**), **Linimentum Sinapis**, **Linimentum Terebinthinæ**. It is thus contained in eleven of the fifteen liniments of the Pharmacopœia.

Camphor is also an active constituent of **Unguentum Hydrargyri Compositum**. (See page 182.)

## OIL OF EUCALYPTUS

**Oleum Eucalypti.**—‘The oil distilled from the fresh leaves of *Eucalyptus Globulus*, *Labill.*, and other species of *Eucalyptus*.’



FIG. 109.

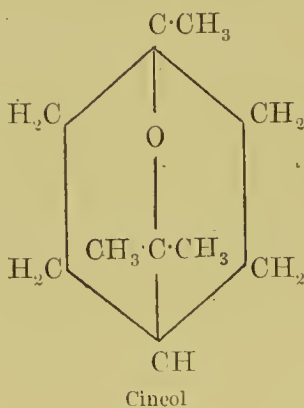
Dried eucalyptus leaf (not official).  $\frac{5}{8}$  linear.

*Characters.*—Colourless or pale yellow, with a powerful characteristic, somewhat camphoraceous odour and taste.

Specific gravity, 0.910 to 0.930. It should contain a proper proportion of cineol and no excess of phellandrene. Tests to ensure this are given in the Pharmacopœia.

Some varieties of eucalyptus yield an inferior oil containing a large proportion of phellandrene.

*Chief Constituents.*—Cineol (50 per cent. or more). Terpenes.



Cineol is also known as eucalyptol and cajuputol.

The oil also contains various aldehydes (butyric, hexoic, valeric, &c.), alcohols (isoamyl), and esters. The terpenes are mainly *d*- and *l*-pinene.

The different eucalyptus oils appear to be fairly constant in composition. Taken as a group, the more active constituents are said to be cineol

and eudesmol, aromadendral (an aldehyde), piperitone (a ketone), aromadendrene (a sesquiterpene), and the terpenes *d*- and *l*-pinene and phellandrene.

*Dose*.— $\frac{1}{2}$  to 3 minims.

*Pharmacology*.—Its action is similar to that of other volatile oils, but it is less irritant and somewhat more antiseptic. It is also a more powerful odorant and deodorant, and it possesses an antiperiodic action, but much less powerful than that of quinine. Like quinine, it inhibits the movements of white blood-corpuscles. Its antiseptic action has been overrated; according to the most recent investigator, this action is due mainly to the presence of ozone. Taken in large doses it produces effects similar to those seen after oil of turpentine, but it appears to have a more distinctly depressant action on the nervous system.

It is a valuable deodoriser, and is useful as an inhalation for this purpose in foetid bronchitis, pulmonary gangrene, and similar conditions. Mixed with an equal quantity of olive oil it is mildly rubefacient, and may be employed as such. It is sometimes given internally as a carminative and as a remedy for chronic bronchitis and chronic inflammations of the urinary tract. As a remedy for malaria it is much inferior to quinine.

**Unguentum Eucalypti**.—Contains 1 of oil of eucalyptus in 10 by weight.

Oil of eucalyptus, 1; hard paraffin, 4; soft paraffin, 5.

*Pharmacology*.—A mild stimulant and antiseptic ointment. Sometimes useful in chronic skin diseases.

## OIL OF LAVENDER

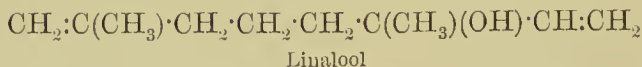
**Oleum Lavandulæ**.—‘The oil distilled from the flowers of *Lavandula vera*, DC.’

*Characters*.—Nearly colourless to pale yellow, with the strong fragrant odour of lavender flowers, and a bitter aromatic taste.

Specific gravity, 0.885 to 0.900. It should dissolve in three times its volume of 70 per cent. alcohol showing the absence of oil of turpentine.



*Chief Constituents.*—Linalool; linalyl acetate.



It also contains various terpenes (pinene, limonene, camphene, a sesquiterpene), geraniol, borneol, cineol, and amyl alcohol.

English (Mitcham) oil of lavender is the best.

*Dose.*— $\frac{1}{2}$  to 3 minims.

*Pharmacology.*—It has the common actions of volatile oils and may be used as a carminative, but is employed mainly as a perfume. It gives a pleasant odour to ointments and other external applications.

**Spiritus Lavandulæ.**—Contains 1 of oil of lavender in 10 by volume.

Oil of lavender, 1 fl. oz.; alcohol (90 per cent.), to make 10 fl. oz.

*Dose.*—5 to 20 minims.

*Pharmacology.*—It may be employed as a carminative and stimulant.

**Tinctura Lavandulæ Composita.**—A red-coloured tincture containing small quantities of the oils of lavender and rosemary, and those of cinnamon bark and nutmeg.

Oil of lavender, 45 minims; oil of rosemary, 5 minims; cinnamon bark, 75 gr.; nutmeg, 75 gr.; red sanders wood, 150 gr.; alcohol (90 per cent.), 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is carminative, but is used mainly as an odorant and colouring agent.

It is contained in **Liquor Arsenicalis**.

Oil of lavender is present in **Linimentum Camphoræ Ammoniatum**.

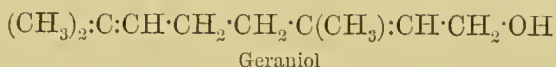
## OIL OF ROSE

**Oleum Rosæ.**—‘The oil distilled from the fresh flowers of *Rosa damascena*, *Linn.*’

*Characters.*—A pale-yellow, partially crystalline, semi-solid substance, with the fragrant odour of the rose and a bitter aromatic taste and sweet after-taste.

Specific gravity, 0·852 to 0·858. The congealing and melting points vary, but lie usually between 19° and 22°C.

*Chief Constituents*.—Geraniol (about 55 per cent.); citronellol (about 20 per cent.).



Small quantities of esters of these alcohols are also present. The crystalline portion of the oil (stearoptene) is inodorous.

*Pharmacology*.—It is used only as a perfume.

It is contained in **Unguentum Aquæ Rosæ**.

**Aqua Rosæ**.—‘The rose water of commerce, prepared by distillation from the flowers of *Rosa damascena*, *Linn.*, diluted, immediately before use, with twice its volume of distilled water.’

The rose water of commerce is a saturated solution of the essential oil in water. It is known as ‘triple’ rose water, and is the water remaining after the oil of rose has been drawn off.

It is often slightly acid, owing apparently to decomposition of the esters in the oil.

*Pharmacology*.—It has a mild sedative action, and is used as a vehicle for lotions and similar preparations, and as a flavouring agent.

**Unguentum Aquæ Rosæ**.—An ointment containing rose water of commerce and oil of rose in a basis of oil and waxes.

Rose water of commerce, 7 fl. oz.; white beeswax, 1½ oz.; spermaceti, 1½ oz.; almond oil, 9 oz.; oil of rose, 8 minims.

*Pharmacology*.—It has an almost pure protective action, and is a pleasant and useful ointment basis.

Rose water is contained in **Mistura Ferri Composita**, and is used in making the **Rose basis of lozenges**.

## ORANGE-FLOWER WATER

**Aqua Aurantii Floris.**—‘The orange-flower water of commerce, prepared by distillation from the flowers of the bitter-orange tree, *Citrus Aurantium*, var. *Bigaradia*, *Hook. f.*, diluted, immediately before use, with twice its volume of distilled water.’

The orange-flower water of commerce is a saturated solution of the essential oil of the fresh flowers in water. It is known as ‘triple’ orange-flower water. The oil of orange flowers is known as *Oleum Neroli*.

*Characters.*—Colourless or, more usually, slightly greenish-yellow, with a fragrant characteristic odour and slightly bitter taste.

It should contain no lead compounds. The fresh water sometimes has a slight empyreumatic smell and an acrid taste, but these disappear on keeping.

*Pharmacology.*—Its action and uses are the same as those of rose water. To most people it is not so pleasant.

**Syrupus Aurantii Floris.**—Orange-flower water saturated with sugar.

Orange-flower water of commerce, 8 fl. oz.; sugar, 3 lb.; distilled water, to make 4½ lb.

*Dose.*—½ to 1 fluid drachm.

*Pharmacology.*—It is a mildly flavouring syrup.

Commercial orange-flower water is a constituent of **Mistura Olei Ricini** and **Syrupus Calcii Lactophosphatis**.

## OIL OF ROSEMARY

**Oleum Rosmarini.**—‘The oil distilled from the flowering tops of *Rosmarinus officinalis*, *Linn.*’

*Characters.*—Colourless or pale yellow, with the odour of rosemary, and a warm, somewhat bitter, camphoraceous taste.

Specific gravity, 0.900 to 0.915. It should dissolve in at least twice its volume of 90 per cent. alcohol, indicating absence of oil of turpentine.

*Chief Constituents*.—Borneol (about 6 per cent.), bornyl acetate and other esters (about 20 per cent.) ; terpenes.

The terpenes are pinene and camphene. It also contains camphor and cineol.

*Dose*.— $\frac{1}{2}$  to 3 minims.

*Pharmacology*.—It has the action of a volatile oil. It is almost solely used externally as an ingredient of liniments and hair lotions.

**Spiritus Rosmarini**.—Contains 1 of oil of rosemary in 10 by volume.

Oil of rosemary, 1 fl. oz. ; alcohol (90 per cent.), to make 10 fl. oz.

*Pharmacology*.—It is a convenient solution of the oil for use in lotions, liniments, &c. It is rarely given internally.

Oil of rosemary is contained in **Linimentum Saponis** and **Tinctura Lavandulæ Composita**.

## OIL OF CAJUPUT

**Oleum Cajuputi**.—‘The oil distilled from the leaves of *Melaleuca Leucadendron*, *Linn.*’

*Characters*.—Bluish-green, with a strong characteristic, somewhat camphoraceous odour, and a pungent, bitter camphoraceous taste.

Specific gravity, 0.922 to 0.930. On the addition of a third to half its volume of phosphoric acid (specific gravity, 1.750), it should become semi-solid when stirred, showing the presence of a proper proportion of cineol.

*Chief Constituents*.—Cineol (50 per cent. or more) ; terpenes (*l*-pinene).

It also contains terpinol and its acetate and various aldehydes (butyric, valeric, benzoic).

*Pharmacology*.—It has the typical action of a volatile oil. Applied externally it produces a rubefacient action, like oil of turpentine, but is less powerful than this. Taken internally in small doses it is a powerful carminative.



Diluted with two or three times its volume of olive oil it is a useful remedy for pains in and around joints (chronic rheumatism, &c.), for muscular pain (lumbago, sprains, &c.), and for chilblains. It may also be used for patchy baldness (alopecia areata) and the later stages of ringworm. Internally it is useful as a carminative in flatulence and other conditions, but possesses no advantage over other and pleasanter volatile oils.

**Spiritus Cajuputi.**—Contains 1 of oil of cajuput in 10 by volume.

Oil of cajuput, 1 fl. oz. ; alcohol (90 per cent.), to make 10 fl. oz.

*Dose.*—5 to 20 minims.

*Pharmacology.*—Employed as a carminative in flatulence and colic, and as a remedy in hysteria.

**Linimentum Crotonis.**— $3\frac{1}{2}$  in 8 by volume. See page 544.

#### OIL OF JUNIPER

**Oleum Juniperi.**—‘The oil distilled from the full-grown unripe green fruit of *Juniperus communis*, *Linn.*’

The oil obtained from the ripe fruits is superior, and is that usually found in commerce.

*Characters.*—Colourless or pale greenish-yellow, with the characteristic odour of the fruit and a bitter aromatic taste.

Specific gravity, 0.865 to 0.890.

*Constituents.* — Terpenes—pinene, cadinene (a sesquiterpene) ; juniper camphor and its acetic ester.

*Dose.*— $\frac{1}{2}$  to 3 minims.

*Pharmacology.*—Its action is similar to that of oil of turpentine. It is, however, more pleasant and less irritating. It is a useful carminative for those who enjoy its flavour, but it is mainly used for its action on the kidneys. In small doses it stimulates these and increases the amount of urine excreted ; in large doses it irritates and may cause inflamma-

tion, and also irritates the lower part of the urinary tract. It gives the urine a violet-like odour.

It is employed as a diuretic, usually in combination with a saline diuretic, in the dropsy of hepatic and chronic renal disease. It may be used for flatulence and colic. Gin, especially 'Hollands,' owes much of its activity to oil of juniper.

**Spiritus Juniperi.**—Contains 1 of oil of juniper in 20 by volume.

Oil of juniper, 1 fl. oz.; alcohol (90 per cent.), to make 20 fl. oz.

*Dose.*—20 to 60 minims.

It is contained in **Mistura Creosoti** as a flavouring agent.

## OIL OF SANDAL WOOD

**Oleum Santali.**—'The oil distilled from the wood of *Santalum album*, *Linn.*'

*Characters.*—A pale-yellow, somewhat viscid oil, with a characteristic aromatic odour and a warm, slightly acrid taste.

Specific gravity, 0.973 to 0.976. It should contain no cedar wood oil or other varieties of sandal wood oil.

*Chief Constituent.*—**Santalol** (about 94 per cent.), which is a mixture of two sesquiterpene alcohols.

An aldehyde (santalal) and esters also occur.

*Dose.*—5 to 30 minims.

*Pharmacology.*—It has the characteristic action of volatile oils, but is milder than most of these. It is most closely allied in action to the oils of copaiba and cubebs (page 522). It is employed mainly for its stimulant action on the urethral mucous membrane in subacute and chronic gonorrhœa, and occasionally for a similar action on the bronchial mucous membrane in chronic bronchitis. It is usually administered in capsules.

## OIL OF TURPENTINE

Crude turpentine is an oleo-resin formed in a branching system of special secreting ducts occurring in the wood of many coniferous trees. In the Southern United States, which supply most of the turpentine and its products imported into this country, a shelving cavity ('box') is made at the base of the tree in winter, and in spring the bark and subjacent part of the wood above are removed, and other triangular incisions are made. The crude turpentine flows from these into the box, and is removed for distillation. The last portions of the exudation are thick, and, after partially drying, form incrustations on the bark. These are scraped off and exported. They form the official *Thus Americanum*, or common frankincense. The crude turpentine is distilled with water. The oily portion of the distillate when rectified forms the *Oleum Terebinthinæ* of the Pharmacopœia; the residue left in the still when freed from water is the official *Resina* (colophony).

**Oleum Terebinthinæ.**—'The oil distilled, usually by the aid of steam, from the oleo-resin (turpentine) obtained from *Pinus sylvestris*, *Linn.*, and other species of *Pinus*; rectified if necessary.'

*Characters.*—A colourless mobile liquid, with a strong characteristic odour, and an unpleasant pungent somewhat bitter taste. The odour of different oils varies slightly. Almost insoluble in water; miscible in all proportions with absolute alcohol, ether, or chloroform.

Specific gravity, 0.860 to 0.880. It should begin to boil at 155°C., and about four-fifths should distil below 165°C., the whole distilling below 180°C. It should dissolve in its own volume of glacial acetic acid.

*Constituents.*—Terpenes, mainly *d*- or *l*-pinene.

American oil of turpentine consists chiefly of *d*-pinene, but also contains *l*-camphene, fenchene, and small quantities of dipentene. French oil of turpentine, also imported into this country, consists mainly of *l*-pinene.

Oil of turpentine also contains small quantities of other substances, mainly oxidation products, resin acids, formic, acetic, camphoric acids, and camphoric aldehyde. These are increased by passing air through the oil, and a considerable quantity of hydrogen peroxide is also produced. 'Sanitas,' which owes its activity mainly to hydrogen peroxide, is produced in this way.

*Dose.*—2 to 10 minims; as an anthelmintic, 3 to 4 fluid drachms.

*Pharmacology.*—It has the fundamental actions of a volatile oil. When applied to the skin, it produces, after a short time, a feeling of warmth and pricking, and the part becomes congested and tender to the touch. If the application is continued, inflammation and vesication result. Applied to wounded surfaces it causes smarting, burning pain, and stops bleeding. It is absorbed to a slight extent from the skin.

When taken by the mouth in pharmacopœial doses, it has a sharp, bitter, burning taste, produces reflex salivation, and acts as a carminative in the stomach and intestines. It is absorbed, but produces no distinct effects beyond more or less diuresis. Larger doses (1 to 2 drachms) produce a marked feeling of warmth in the stomach, often nausea, and may cause distinct irritation of the intestines. It is absorbed in greater part and produces decided renal irritation (lumbar pain, albumen and even blood in the urine), vesical strangury, and symptoms of cerebral excitement or depression. Still larger doses (4 drachms or more) may cause only gastrointestinal irritation, nearly the whole of the turpentine being discharged in the diarrhœa produced; but if absorbed, they cause stupefaction, unconsciousness, and coma, rarely convulsions, and inflammation of the kidneys and other effects.

Turpentine is excreted mainly in combination with glyconic acid in the urine. It gives to the urine a smell somewhat resembling violets.

It is commonly said to be a powerful antiseptic, but fresh (pure) oil of turpentine has only weak antiseptic properties. It becomes more powerful after exposure to the air ('ozonised').

It is employed externally as a rubefacient and counter-irritant, and, to a less extent, as a hæmostatic. As a counter-irritant it is generally used in the form of a stupe (flannel wrung out of hot water and sprinkled with oil of turpentine). Like other counter-irritants, it is often beneficial in visceral inflammations (pleurisy, peritonitis, bronchitis) and deep-seated abdominal and muscular pains. For the last-named and for pains around joints the official liniments are to be preferred.



It is given internally for bleeding from the stomach and intestines, and as an anthelmintic for tapeworms. For the latter purpose it must be given in large doses, preferably with castor oil, but on account of its liability to be absorbed this treatment is not free from danger. It is said to be useful in the later stages of typhoid fever. As an enema, mixed with oil, it is often beneficial in flatulence and intestinal ulceration.

Oil of turpentine has been given for various other diseases and conditions, but for these other and better remedies exist.

**Linimentum Terebinthinæ.**—Contains 13 fluid ounces of oil of turpentine and 1 ounce of camphor in 20 fluid ounces.

Oil of turpentine, 13 fl. oz.; camphor, 1 oz.; soft soap,  $1\frac{1}{2}$  oz.; distilled water, to make 20 fl. oz.

*Pharmacology.*—It is a powerfully stimulating liniment, useful for muscular pains, joint pains, and allied conditions.

**Linimentum Terebinthinæ Aceticum.**—Consists of oil of turpentine, 4 fluid ounces; glacial acetic acid, 1 ounce; liniment of camphor, 4 fluid ounces.

*Pharmacology.*—Its action and uses are similar to those of the previous liniment. It is a cleaner application, being more easily rubbed into the skin.

**Terebenum**—terebene. ‘A mixture of dipentene and other hydrocarbons.’ It contains also small quantities of oxidation products.

The Pharmacopœia says that it is ‘obtained by agitating oil of turpentine with successive quantities of sulphuric acid until it no longer rotates the plane of a ray of polarised light, and then distilling in a current of steam’; but an optically inactive product can be obtained only from French oil of turpentine. That obtained from American oil of turpentine possesses slight optical activity.

*Characters.*—A colourless limpid liquid with an odour and taste resembling that of oil of turpentine, but much more agreeable.

Specific gravity, 0·862 to 0·866. Not more than 15 per cent. should distil below 165°C.; the whole should distil below 180°C., and not more than a slight amount of a viscid residue should remain.

*Constituents.*—Dipentene and terpinene mainly.

Small quantities of cymene, camphene, and other substances are also present.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action is similar to that of oil of turpentine, but it has a more agreeable smell and taste. It is used chiefly as an inhalation (added to hot water or placed in a respirator), but is also given internally, in chronic bronchial and pulmonary affections.

#### OIL OF PINE

**Oleum Pini.**—‘The oil distilled from the fresh leaves of *Pinus Pumilio*, *Haenke*.’

*Characters.*—Colourless or slightly yellow, mobile, with a characteristic pleasant aromatic odour and a pungent taste.

It is distinguished from most other pine oils by its low specific gravity (0·865 to 0·870) and its slight optical activity (5 to 10 degrees to the left). Not more than 10 per cent. should distil below 165° C., showing the absence of oil of turpentine.

*Constituents.*—Terpenes; bornyl acetate (about 5 per cent.).

The terpenes are *l*-pinene, *l*-phellandrene, sylvestrine, cadinene, and dipentene. The pleasant odour is due mainly to the bornyl acetate.

*Pharmacology.*—Its action and uses are similar to those of terebene. It may be given in doses of 3 to 5 minims, but it is employed chiefly as an inhalation.

The oils of copaiba and cubebs are described later (pages 522, 523).

## RESINS, OLEO-RESINS, GUM-RESINS, BALSAMS, AND DRUGS CONTAINING THEM

THE action of these substances, with few exceptions, is somewhat similar to that of volatile oils. Resins are less active because they are neither volatile nor soluble in water, and are only slightly soluble in alkaline media at the temperature of the body. Therefore when applied to the skin they only produce a mild irritant action after having been applied for some time; and when taken by the mouth only a small quantity is absorbed, and this is insufficient to produce any marked general action; it only serves to stimulate the excretory organs. The resin contained in gamboge (a gum-resin), and the resins of jalap, scammony, and podophyllum, which have been already described, are the only powerfully active resins. In the presence of alkalies these are irritant, and in small doses produce marked purgation.

The action of an oleo-resin is that of the volatile oil and resin it contains, the oil being the more active factor. The action of a gum-resin is due to the resin, of a balsam to the resin and the benzoic or cinnamic acid which it contains or yields.

This class of drugs is used almost solely for a local action on the skin or alimentary tract, or for a stimulating action on the bronchial mucous membrane, the kidney, or genito-urinary tract.

### RESIN

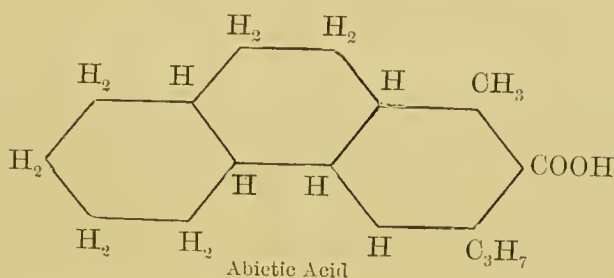
**Resina.**—‘The residue left after the distillation of the oil of turpentine from the crude oleo-resin (turpentine) of various species of *Pinus*.’

*Characters.*—Light amber-coloured, translucent, brittle masses, with a faint terebinthinate odour and taste. It breaks with a shining conchoidal fracture, is readily powdered, easily fusible, and burns with a smoky flame. Insoluble in water; readily soluble in alcohol, ether, and oil of turpentine.

Specific gravity, 1.070 to 1.085. It should yield no appreciable amount of ash.

The lightest coloured resin is obtained from the turpentine exuding from trees tapped for the first time. Crude turpentine yields 80 per cent. or more.

*Chief Constituent.*—The anhydride of abietic acid (80 to 90 per cent.).



Abietic acid is probably decahydroretenecarboxylic acid.

Other anhydrides of allied acids (pimaric, &c.) and hydrocarbons (abietene, &c.) occur in varying amounts. Small quantities of proto-catechuic acid and an allied aldehyde, vanillin, and of a bitter substance are usually present.

On dry distillation resin yields the so-called rosin-oil or resinol (mainly abietene) which has a very mild volatile-oil action. It is used in therapeutics, but is not official.

*Pharmacology.*—Applied to the skin in the form of an ointment it is mildly stimulant; to abraded surfaces it is somewhat irritant. In the form of a plaster it has a similar but weaker action. In either form it may be used to stimulate healthy growth in indolent ulcers.

### Emplastrum Resinæ—adhesive plaster.

Resin, 2; lead plaster, 16; hard soap, 1.

It is the basis of Emplastrum Belladonnæ and Emplastrum Opii, and is contained in Emplastrum Calefaciens.

Resin itself is an ingredient of Emplastrum Calefaciens, Emplastrum Cantharidis, Emplastrum Menthol, Emplastrum Picis, Emplastrum Plumbi Iodidi, and Emplastrum Saponis.



**Unguentum Resinæ.**—Contains 4 of resin in 15 by weight.

Resin, 8; yellow beeswax, 8; lard, 6; olive oil, 8.

### GUAIAECUM WOOD

**Guaiaci Lignum.**—‘The heart-wood of *Guaiacum officinale*, *Linn.*, or *Guaiacum sanctum*, *Linn.*’

*Characters.*—Imported in logs 6 to 8 inches long and 5 or 6 inches in diameter, but usually seen as chips, raspings, or turnings. It is greenish-brown in colour, very hard,

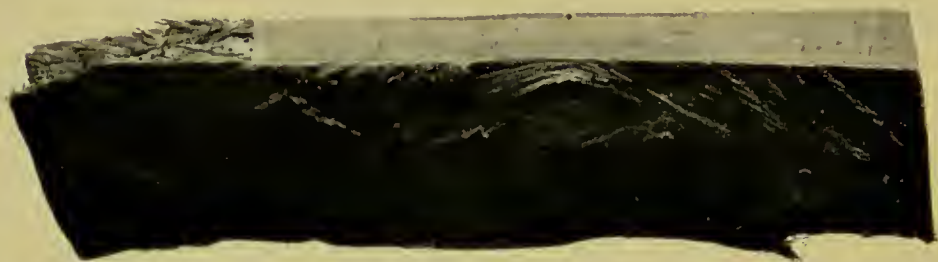


FIG. 110.

Guaiacum wood, showing darker and lighter bands in longitudinal section.  $\frac{1}{2}$  linear.

sinks in water, and has a faint aromatic odour, increased by heating, and, when chewed, an acrid taste. A section of the wood shows alternate bands or zones of brown and dark olive-green. The addition of a solution of ferric chloride to an alcoholic extract produces a blue colour.

*Chief Constituents.*—The official **resin** (about 20 per cent.); a saponin and a bitter pungent substance (small quantities).

The resin is composed chiefly of an amorphous acid, guaiaconic acid (60 to 70 per cent.), and two crystalline acids, guaiaretic acid (10 per cent.) and guaiacic acid (small quantities), all of which are believed to be condensation products of tiglic aldehyde and guaiacol. The blue colour obtained with oxidising agents is due to guaiaconic acid.

Guaiacum wood is used mainly to prepare Guaiacum resin. The water-soluble ingredients are present in *Liquor Sarsæ*

*Compositus Concentratus*, but have very little pharmacological action.

**Liquor Sarsæ Compositus Concentratus.** See page 379.

**Guaiaci Resina.**—‘The resin obtained from the stem of *Guaiacum officinale*, *Linn.*, or of *Guaiacum sanctum*, *Linn.*’

*Characters.*—Dark-green, yellowish-green, or reddish-brown brittle masses or tears, breaking with a vitreous fracture and having a faint balsamic odour (more marked on heating) and a somewhat acrid taste. It is readily reduced to powder, which is greyish in colour but becomes green by keeping. An alcoholic solution gives a blue colour with solution of ferric chloride.

*Constituents.*—See page 516.

It may contain a considerable amount of extraneous matter (vegetable débris, &c.). On dry distillation it yields guaiacol, creosol, and other substances.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It has an unpleasant, slightly acrid taste, but is generally well borne by the stomach in ordinary doses. Under the influence of the alkaline juices of the intestines it is absorbed, and during excretion stimulates the various organs of excretion to a slight extent. It has been given in a number of diseases, but with questionable benefit. It is said, however, to be useful in certain gouty manifestations (gouty bronchitis, &c.), in chronic rheumatism, tonsillitis, amenorrhœa, and certain skin diseases. It has been used in syphilis, but is of doubtful value.

**Mistura Guaiaci.**—Contains  $\frac{1}{2}$  ounce of guaiacum resin in 20 fluid ounces.

Guaiacum resin,  $\frac{1}{2}$  oz.; sugar,  $\frac{1}{2}$  oz.; tragacanth, 35 gr.; cinnamon water, 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Tinctura Guaiaci Ammoniata.**—Contains 1 ounce of guaiacum resin and 3 fluid drachms of strong solution of

ammonia in 5 fluid ounces. It is flavoured with the oils of nutmeg and lemon.

Guaiacum resin, 4 oz.; strong solution of ammonia,  $1\frac{1}{2}$  fl. oz.; oil of nutmeg, 30 minims; oil of lemon, 20 minims; alcohol (90 per cent.) to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has the combined action of its individual ingredients. The ammonia acts as a stimulant and the oils tend to prevent any irritation of the stomach or intestines.

**Trochiscus Guaiaci Resinæ.**—Each lozenge contains 3 grains of guaiacum resin. Fruit basis.

*Pharmacology.*—It has an unpleasant acrid taste. It is chiefly used for tonsillitis and pharyngitis, but is also employed to obtain the general effects of the resin.

**Pilula Hydrargyri Subchloridi Composita.** — Nearly half consists of guaiacum resin. (See page 188.)

## OLEO-RESINS AND DRUGS CONTAINING THEM

### COMMON FRANKINCENSE

**Thus Americanum.**—‘The concrete oleo-resin which is scraped off the trunks of *Pinus palustris*, *Mill.*, and *Pinus Tæda*, *Linn.*’

*Characters.*—A pale yellow, opaque, tough solid, with a terebinthinate odour and taste, soft when fresh, but becoming darker, hard, and translucent by keeping.

*Constituents.*—Resin; oil of turpentine; free abietic and pimaric acids. The proportion of oil is variable; it diminishes by keeping.

*Pharmacology.*—It is somewhat more stimulant than common resin.

**Emplastrum Picis.**—Contains approximately 1 of frankincense in 4. (See page 519.)

## BURGUNDY PITCH

**Pix Burgundica.**—‘The resinous exudation obtained from the stem of *Picea excelsa*, *Link*, melted and strained.’

*Characters.*—Yellowish-brown or reddish-brown masses, opaque, but becoming translucent on the surface by keeping, brittle, but gradually taking the form of the vessel in which it is kept, breaking with a dull resinous fracture, and having a slight somewhat aromatic odour and taste.

It should be readily soluble in glacial acetic acid.

*Constituents.*—*d*- and *l*-Pimaric acids, oil of turpentine, and small quantities of a more fragrant volatile oil.

*Pharmacology.*—Its action is similar to that of common frankincense. It is mainly used in the form of the plaster for its stimulant action on the skin.

**Emplastrum Picis.**—Consists chiefly of resinous and oleo-resinous ingredients. Approximately half is Burgundy pitch.

Burgundy pitch, 26 ; frankincense, 13 ; resin,  $4\frac{1}{2}$  ; yellow beeswax,  $4\frac{1}{2}$  ; olive oil, 2 ; distilled water, 2. Most of the water is evaporated off during the process of preparation. It serves to prevent the other ingredients from burning.

*Pharmacology.*—On account of its mild irritant action it is used to relieve pain in joints and muscles. It is sometimes applied to the chest as a mild counter-irritant.

## CANADA TURPENTINE

**Terebinthina Canadensis.**—Canada balsam. ‘The oleo-resin obtained from *Abies balsamea*, *Mill*.’

*Characters.*—A pale-yellow transparent viscid liquid, often showing a slight greenish fluorescence, drying on exposure to air to a transparent varnish, with an agreeable terebinthinate odour, and a terebinthinate, afterwards bitter and slightly acid taste. Partially soluble in alcohol ; readily soluble in ether, chloroform, benzene, xylol, and oil of turpentine.



It should form a solid mass when mixed with about one-sixth its weight of magnesia moistened with water.

*Constituents.*—Resinous matter (about 75 per cent.); volatile oil (about 24 per cent.).

The resinous portion consists of resin acids (63 per cent., consisting of  $\alpha$ - and  $\beta$ -canadinolic acids, canadinic acid, and a small amount of canadolic acid) and an indifferent resin, canadoresene. The volatile oil consists chiefly of *l*-pinene.

The oleo-resin also contains small quantities of a bitter substance, extractive matter, and succinic and other acids.

*Pharmacology.*—Its action is similar to, but somewhat more powerful than, the foregoing oleo-resins. It is rarely employed medicinally.

**Collodium Flexile.**—See page 562.

#### COPAIBA

**Copaiba.**—‘The oleo-resin obtained from the trunk of *Copaifera Lansdorffii*, *Desf.*, and other species of *Copaifera*, *Linn.*’ It should contain at least 40 per cent. of volatile oil.

*Characters.*—A pale-yellow to yellowish-brown viscid liquid, usually transparent, but sometimes showing slight fluorescence and opalescence, with a peculiar characteristic odour, and an unpleasant acrid, somewhat bitter taste. Almost insoluble in water; readily soluble in absolute alcohol, ether, chloroform, fixed oils, and oil of turpentine.

Tests are given in the Pharmacopœia to show the absence of fixed oil, African copaiba, and gurjun balsam.

*Constituents.*—Resinous matter; volatile oil. The proportions vary; from 40 to 60 per cent. of volatile oil is usually present, but there may be more, and in some products there is less, but these are not official.

The resinous portion consists chiefly of copaivic, oxycopaivic, and metacopaivic acids. The volatile oil consists mainly of a sesquiterpene, probably caryophyllene.

Small quantities of a bitter principle are present.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is that of the volatile oil and resin which compose it. As it contains a larger proportion of volatile oil than the preceding oleo-resins it is a more powerful stimulant and irritant. It is not, however, used externally.

It has an unpleasant acrid and somewhat bitter taste. When taken in 20-minim doses it produces a feeling of warmth in the stomach, occasionally some nausea, often eructations accompanied by the unpleasant taste of the drug, but usually no other obvious effects. It is absorbed and is excreted in the main by the kidneys. Part of the terpene constituent is excreted through the lungs, but the greater part passes into the urine and appears in combination with glycuronic acid. During excretion the copaiba stimulates the kidneys and produces diuresis. The bronchial mucous membrane is stimulated if relaxed.

A full pharmacopœial dose (60 minims) usually causes nausea and often vomiting, sometimes colic and diarrhœa. After absorption it irritates the kidneys and produces pain in the loins, painful micturition, and often albumen in the urine. Larger doses cause marked gastric, intestinal, and renal irritation.

Small doses repeatedly administered produce loss of appetite and other gastric symptoms and in some cases diarrhœa. A frequent ill-effect is cutaneous eruptions, the most common being a measles-like eruption on the hands, the legs, or other part of the body, or even affecting nearly the whole body.

The reactions of the urine are sometimes misleading. After the administration of copaiba the addition of nitric acid produces a precipitate which has been mistaken for albumen. This is the precipitated resin, and differs from albumen in disappearing on heating and being soluble in alcohol. The urine also usually reduces Fehling's solution owing to the glycuronic acid excreted in combination with the terpene.

Copaiba is principally used for subacute and chronic gonorrhœa in the male. It is not advisable to exceed 20 or 30 minim doses. The resin (not official as such) is sometimes given in dropsy due to cardiac or hepatic disease.

**Oleum Copaibæ.**—‘The oil distilled from Copaiba.’

*Characters.*—Colourless or slightly yellow, with the odour and the taste of copaiba.

Specific gravity, 0·900 to 0·910. It should contain no African copaiba oil or gurjun oil.

*Chief Constituent.*—A sesquiterpene (see page 520).

*Dose.*—5 to 20 minims.

*Pharmacology.*—It has the actions common to volatile oils, but is less powerful than many. It has been used principally for chronic bronchitis.

## CUBEBS

**Cubebæ Fructus.**—‘The dried full-grown unripe fruits of *Piper Cubeba*, *Linn. fil.*’

*Characters.*—Nearly globular, greyish-brown or almost black fruits, about  $\frac{1}{8}$  inch in diameter, markedly reticulated

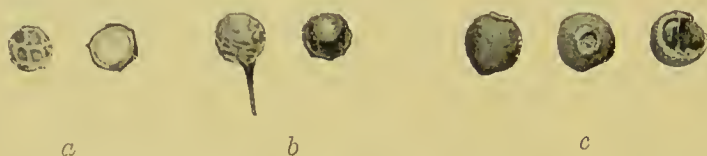


FIG. 111.

(b) Cubebs ; whole fruit with stalk, and section showing single seed. (a) Pepper. (c) Pimento. Natural size.

and stalked—the stalk being a prolongation of the pericarp—and about  $\frac{1}{4}$  inch in length. The fruit is unicellular and contains a single seed, usually only partially developed, attached by the base. The odour, especially of the crushed seed, is strongly aromatic and characteristic; the taste is aromatic and somewhat bitter.

If the crushed fruit is added to sulphuric acid it produces a crimson colour owing to the presence of cubebin and cubebic acid. This, in conjunction with the microscopic appearance of the pericarp—a layer of sclerenchymatous cells near the outer, and a similar radially elongated layer near the inner, surface—is characteristic.

Compare with black pepper (which has a different taste and odour and is not stalked) and with pimento (which is not obviously reticulated, is reddish-brown, and contains two seeds).

*Chief Constituents.*—A volatile oil (14 per cent. or more) ; resin (4 per cent. or more).

Cubebin (about 2 per cent.), a colourless crystalline substance, and small quantities of piperine (page 288) occur.

The volatile oil consists chiefly of a sesquiterpene, cadinene, but contains dipentene and cubeb-camphor; the resin is composed of cubebic acid (about two-fifths) and indifferent resin.

*Dose.*—30 to 60 grains.

*Pharmacology.*—Its action is somewhat similar to that of copaiba, but, as it only contains a fraction (about one-fifth) of active ingredients, is weaker. It is more pleasantly aromatic and more distinctly carminative and is less liable to disorder the stomach or produce skin eruptions than copaiba. When taken in full pharmacopœial doses it produces a feeling of warmth in the stomach, and large doses produce gastrointestinal irritation. The oil and resin are absorbed and act upon the kidney and urinary tract, and the bronchial mucous membrane, like copaiba. They are excreted in a similar manner and the urine shows the same reactions as after copaiba.

It is employed in subacute and chronic inflammations of the urinary tract, especially in gonorrhœa, and is generally administered mixed with glycerin or syrup as a bolus, or wrapped in wafer-paper. The oleo-resin, made into a lozenge, is sometimes employed in pharyngeal catarrh. Cubeb cigarettes are used in chronic bronchial catarrh, asthma, and allied conditions.

**Oleum Cubebæ.**—‘The oil distilled from Cubebs.’

*Characters.*—Colourless or slightly green or greenish yellow, with the odour and taste of cubebs.

Specific gravity, 0·910 to 0·930.

*Constituents.*—See above.

*Dose.*—5 to 20 minims.

*Pharmacology.*—Its action is practically the same as that of oil of copaiba; it has a pleasanter odour and taste. It is employed chiefly in chronic bronchitis with profuse expectoration.



## GUM-RESINS

The action of gum-resins is dependent mainly on the resin they contain, in some cases also on the presence of a small amount of volatile oil. The gum merely acts the part of a suspending agent when the substance is rubbed up with water.

## MYRRH

**Myrrha.**—‘A gum-resin obtained from the stem of *Balsamodendron Myrrha*, *Nees*, and probably other species.’

*Characters.*—Dusty, reddish-yellow or reddish-brown, irregular or rounded tears, or masses of tears, varying greatly in size, but commonly about 1 inch long and  $\frac{3}{4}$  inch thick. Fracture unctuous and granular; the fractured surface has a rich brown colour, a somewhat translucent appearance, and often shows whitish marks. The odour is aromatic and characteristic; the taste aromatic, somewhat bitter and acrid.

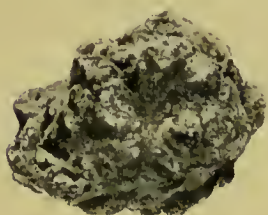


FIG. 112.

A piece of Myrrh, showing rounded tuberosities (tears). Natural size.

It is not infrequently adulterated. The odour and taste and the violet colour produced by moistening it with nitric acid usually serve to distinguish it (from bdellium, &c.).

*Constituents.*—Resin (25 to 40 per cent.); volatile oil (2.5 to 8 per cent.); gum (50 per cent. or more).

The gum resembles arabin; the resin consists of resin-acids and indifferent resin; the volatile oil is of unknown composition.

*Pharmacology.*—It is mildly stimulant externally, carminative when taken internally. It is also a mild expectorant and diuretic, and is credited with so-called emmenagogue properties.

**Tinctura Myrrhæ.**—Contains the resin and oil of 1 ounce of myrrh in 5 fluid ounces.

Myrrh, 4 oz.; alcohol (90 per cent.), to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is applied to spongy gums and aphthous ulcerations; as a mouth-wash with borax it is employed in ‘sore mouth,’ and as a gargle it is used for faucial catarrh. It is given internally in amenorrhœa, but is of doubtful value.

*Pilula Aloes et Myrrhæ.*—See page 410.

*Pilula Galbani Composita.*—See page 527.

Myrrh is also contained in *Pilula Rhei Composita*, *Mistura Ferri Composita*, *Decoctum Aloes Compositum*.

## AMMONIACUM

**Ammoniacum.**—‘A gum-resin exuded from the flowering and fruiting stem of *Dorema Ammoniacum*, *D. Don*, and probably other species.’

*Characters.*—Pale yellowish to brownish tears or nodular masses, hard and brittle at ordinary temperatures, but quickly becoming soft when warmed. It breaks with a conchoidal fracture, the freshly fractured surface having a milk-white or slightly yellowish waxy appearance. When rubbed with water it forms a white emulsion. The odour is faint, but characteristic; the taste is somewhat bitter and acrid.

The freshly fractured surface or the emulsion is turned yellow by caustic potash solution, dark red or orange by solution of chlorinated soda, and transiently violet by solution of ferric chloride. It does not give the umbelliferone test (see page 526).



FIG. 113.

*Ammoniacum.* A tear, showing appearance of section. Natural size.

*Constituents.*—Resin (65 to 70 per cent.); gum (about 20 per cent.); volatile oil (1 to 2 per cent.).

The resin consists of galba-resinotannol and ammo-resinotannol. The gum is allied to gum acacia. *Ammoniacum* contains no umbelliferone, but contains traces of salicylic acid.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It is mildly irritant externally, slightly expectorant and diuretic when taken internally.

**Mistura Ammoniaci.**—Contains  $\frac{1}{4}$  ounce of ammoniacum in 8 fluid ounces.

Ammoniacum,  $\frac{1}{4}$  oz.; syrup of tolu,  $\frac{1}{2}$  fl. oz.; distilled water to make 8 fl. oz. The mixture is strained through muslin.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

*Pharmacology.*—It has the unpleasant acrid taste of ammoniacum. It is used chiefly in the treatment of chronic bronchitis with much expectoration in old people.

**Emplastrum Ammoniaci cum Hydrargyro.**—Consists approximately of  $\frac{4}{5}$  of ammoniacum and  $\frac{1}{5}$  of mercury (see page 182).

Ammoniacum is an ingredient of **Pilula Ipecacuanhæ cum Scilla** and **Pilula Scillæ Composita**. It is included in both for its expectorant action.

## GALBANUM

**Galbanum.**—‘A gum-resin obtained from *Ferula galbaniflua*, *Boiss. and Buhse*, and probably from other species.’

*Characters.*—May occur in small rounded or irregular tears, but is usually seen in irregular masses consisting of tears embedded in a greater or less amount of a brownish matrix, and contaminated with pieces of root and other débris. The tears are yellowish-brown or orange-brown, and rough externally, usually yellowish and opaque, but occasionally bluish-green and translucent, internally. Except in cold weather, they can be indented with the finger-nail; at the body-temperature they are soft and ductile. The odour is peculiar and characteristic; the taste is disagreeable, somewhat aromatic and bitter.

It gives the umbelliferone test: a small fragment heated to redness in a dry test-tube, cooled, and extracted with boiling water, yields a solution of umbelliferone which when made alkaline with solution of ammonia gives a blue fluorescence. Or the galbanum may be boiled for fifteen

minutes with about four times its weight of hydrochloric acid, then diluted with an equal volume of water, filtered, and made alkaline with solution of ammonia.

*Constituents*.—Resin (about 60 per cent.) ; gum (15 to 20 per cent.) ; volatile oil (5 to 10 per cent.).

The resin consists of galba-resinotannol combined with umbelliferone (the anhydride of umbellic acid). Small quantities of free umbelliferone are also present. The volatile oil consists of pinene and cadinene.

*Dose*.—5 to 15 grains.

*Pharmacology*.—Its action is similar to that of other members of this group. It has been employed as a stimulant expectorant in chronic bronchitis, and, made into a plaster, has been applied to chronic inflammatory swelling of joints and similar conditions. It is very little used.

**Pilula Galbani Composita**.—Consists of asafetida 2, galbanum 2, myrrh 2, syrup of glucose 1.

*Pharmacology*.—Being almost wholly composed of gum-resins, its action is that of these. It is useful in chronic bronchitis with profuse expectoration.

## ASAFETIDA

**Asafetida**.—‘A gum-resin obtained by incision from the root of *Ferula foetida*, *Regel*; and probably other species.’

*Characters*.—Rounded, or more or less flattened tears, usually agglutinated; yellowish and tough at ordinary temperatures when fresh, but darkening to a reddish-brown and becoming harder by keeping; brittle when cold. The freshly fractured surface is milky-white and opaque, or yellowish and translucent, but gradually becomes pinkish, and finally reddish brown. It forms a white emulsion when triturated with water. The odour is strongly alliaceous and disagreeable; the taste is alliaceous, and somewhat bitter and acid.

It gives the umbelliferone test (see page 526). The freshly fractured surface when moistened with nitric acid diluted with an equal volume of water shows a transient greenish colour. At least 65 per cent. of asafetida



should be soluble in 90 per cent. alcohol, and it should not yield more than 10 per cent. of ash.

*Constituents.*—Resin (60 per cent. or more) ; gum (25 per cent.) ; volatile oil (about 6 per cent.).

The resin consists chiefly of asa-resinotannol combined with ferulic acid. The oil yields 20 to 25 per cent. of sulphur, and appears to consist mainly of organic sulphides.

Free ferulic acid (about 1 per cent.) also occurs.

*Dose.*—5 to 15 grains.

*Pharmacology.*—It is carminative and expectorant, and, mainly on account of its unpleasant smell and taste, is useful in hysterical and allied conditions. It is of considerable service in flatulence. For this condition it is commonly given as an enema. It is also useful in chronic bronchitis.

**Tinctura Asafetidæ.**—Contains the oil and resin of 1 ounce of asafetida in 5 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm:

**Spiritus Ammoniaë Fetidus.**—Contains 1 fluid ounce of strong solution of ammonia and the volatile oil of  $\frac{3}{4}$  ounce of asafetida in 10 fluid ounces.

There is 2.88 grammes of ammonia in 100 c.c.

*Dose.*—20 to 40 minims for repeated administration, 60 to 90 minims for a single administration.

*Pharmacology.*—Its action and uses are similar to those of aromatic spirit of ammonia. It is especially useful in hysterical conditions.

**Pilula Aloes et Asafetidæ.**—See page 410.

**Pilula Galbani Composita.**—See page 527.

## GAMBOGE

**Cambogia.** — ‘A gum-resin obtained from *Garcinia Hanburii*, *Hook. f.*’

*Characters.* — Reddish-yellow, longitudinally striated, cylindrical rolls, separate or more or less agglutinated, giving when rubbed with the wetted finger, a bright yellow colour. The fracture is conchoidal, the fractured surface being smooth and of a dull reddish-yellow colour. It forms a bright-yellow powder, and when triturated with water a yellow emulsion. It has no odour, but has a very acrid taste.

It should contain no starch; should be completely dissolved by treating it with alcohol (to dissolve the resin) and afterwards with water to (dissolve the gum); and should yield not more than 3 per cent. of ash.

*Constituents.*—Resin, consisting of cambogic acid (70 to 80 per cent.); gum (15 to 25 per cent.).

*Dose.*— $\frac{1}{2}$  to 2 grains.

*Pharmacology.*—Gamboge differs from other gum-resins in being a powerful purgative. It has an acrid taste. In doses of  $\frac{1}{2}$  grain it causes purgation accompanied by griping pain, and in full pharmacopœial doses produces severe colic and diarrhœa, and often gastric irritation. It is sometimes given in obstinate constipation and to relieve cerebral congestion, but is comparatively rarely used. It is best combined with some other purgative and a carminative, as in the official pill.

**Pilula Cambogiæ Composita.**—Contains gamboge, Barbados aloes, and compound cinnamon powder, one-sixth its weight of each.

Gamboge, 1; Barbados aloes, 1; compound powder of cinnamon, 1; hard soap, 2; syrup of glucose, 1.

*Dose.*—4 to 8 grains.



FIG. 114.

Gamboge. Natural size.

## BALSAMS

The balsams are resins or oleo-resins containing benzoic or cinnamic acids, or both, free or combined. The presence of these acids or their esters gives these resinous products an agreeable odour and taste, and increases their efficacy in some directions. Their action may be regarded as that of a resin and benzoic acid. They are generally preferred to other members of the resin-group when a stimulant action on the bronchial mucous membrane is required.

## BENZOIN

**Benzoinum.** — ‘A balsamic resin obtained from *Styrax Benzoïn*, *Dryand.*; and probably from other species of *Styrax*, *Linn.* Known in commerce as Siam and Sumatra benzoin.’

*Characters.* — Siam benzoin. — Pale-yellow to reddish-brown, flat or curved tears, up to 2 inches in length, and

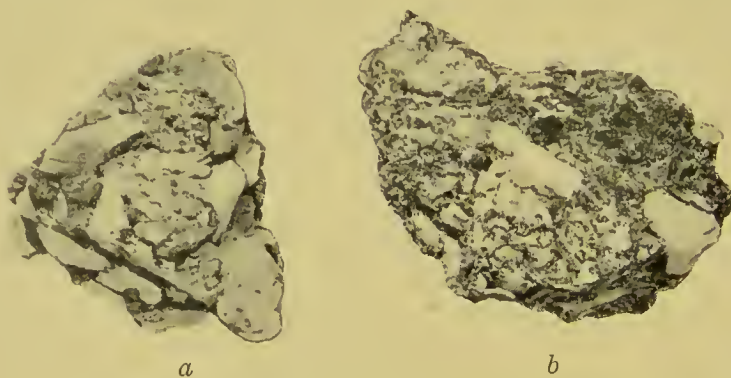


FIG. 115.

(a) Siam (b) Sumatra Benzoin. Natural size.

$\frac{1}{2}$  inch in thickness, hard and brittle at ordinary temperatures, breaking with a conchoidal fracture, the fractured surface being milky white and opaque; or tears embedded in more or less of a reddish-brown translucent matrix. The odour is somewhat vanilla-like; the taste is at first vanilla-like, but afterwards slightly acrid.

Sumatra benzoin.—The tears are embedded in a greyish-brown opaque matrix which is usually much more abundant than in the case of Siam benzoin. The odour resembles that of storax.

Both varieties soften when warmed, and on further heating benzoic acid sublimes. They are slightly soluble in water and in fats; readily soluble in alcohol, ether, or solution of potassium hydroxide.

There is usually a small amount of impurity, in Sumatra benzoin especially, which is insoluble in alcohol. This should not, however, exceed 10 per cent.

*Constituents.*—Both varieties consist mainly of resin, composed of resin alcohols (benzo-resinol and a resino-tannol) combined with benzoic acid and, in the case of Sumatra benzoin, cinnamic acid. The free acids also occur.

Siam benzoin consists of benzo-resinol and sia-resinotannol combined with benzoic acid, free benzoic acid, small quantities of vanillin (0·15 per cent.), and an oily aromatic liquid, probably a benzoic ester. The free and combined benzoic acid amounts to 38 per cent.

Sumatra benzoin consists of benzo-resinol and suma-resinotannol combined with benzoic and cinnamic acids, free benzoic and cinnamic acids, small quantities of vanillin, benzaldehyde, styrol, styracin, &c. The free and combined benzoic acid amounts to 18 per cent., the free and combined cinnamic acid to 20 per cent.

*Pharmacology.*—Its action is that of its constituents, benzoic acid or benzoic and cinnamic acids, and resin. Externally it is somewhat antiseptic and stimulant. Taken internally it has an agreeable balsamic taste, acts as a mild carminative in the stomach and intestines, and after absorption as an expectorant, diuretic, urinary antiseptic, &c. It is used solely in the form of its preparations.

**Tinctura Benzoini Composita** — Friars' balsam. Contains benzoin 2 ounces; prepared storax  $1\frac{1}{2}$  ounces; balsam of tolu  $\frac{1}{2}$  ounce; and Socotrine aloes 160 grains; in 20 fluid ounces.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is a useful antiseptic and styptic, and as such is employed in the treatment of wounds. It



causes transient pain. It is sometimes given internally for chronic bronchitis, chronic cystitis, &c., but is more commonly used as an inhalation (2 to 4 drachms to 1 pint of hot water) for chronic inflammatory and foetid conditions of the larynx, bronchi, and lungs.

**Adeps Benzoatus.**—See page 549.

**Unguentum Cetacei.**—See page 552.

Benzoic acid is made largely from benzoin.

#### BALSAM OF PERU

**Balsamum Peruvianum.**—‘A balsam exuded from the trunk of *Myroxylon Pereiræ*, *Klotzsch*, after the bark has been beaten and scorched.’

*Characters.* — A brownish-black, viscid liquid, dark reddish-brown and transparent in thin layers, with an agreeable balsamic odour and a slight balsamic taste, but producing an acrid burning sensation in the throat when swallowed. Almost insoluble in water and fixed oils; readily soluble in chloroform; miscible with an equal volume of 90 per cent. alcohol, but producing a turbid mixture with more than 3 volumes of 90 per cent. alcohol.

Specific gravity, 1.137 to 1.150. Tests are given in the Pharmacopœia to show the absence of copaiba, resins, castor oil and other fatty oils, ethylic alcohol, and gurjun balsam, and the presence of a due proportion of cinnamein.

*Constituents.* — Cinnamein, an oily fluid portion consisting mainly of benzyl benzoate (about 60 per cent.); resin (about 30 per cent.).

Free cinnamic acid and traces of vanillin occur.

Cinnamein contains, besides benzyl benzoate, benzyl cinnamate and small quantities of styracin cinnamate, benzyl alcohol, and cinnamyl alcohol. The resin consists of peru-resinotannol combined with cinnamic and, to a less extent, benzoic acids.

*Dose.*—5 to 15 minims.

*Pharmacology.*—It is mildly antiseptic. Applied to the skin it produces a stimulant and even irritant effect. Taken by the mouth it produces a somewhat acrid sensation on swallowing, has a mild carminative action in the stomach and intestines, and acts as an expectorant and a diuretic after absorption. Resinous matter can be detected in the urine.

It is rarely given internally. Externally it is used as an ointment for scabies and other parasitic skin diseases, for sore nipples, and for bed-sores and indolent ulcers.

## BALSAM OF TOLU

**Balsamum Tolutanum.** — ‘A balsam obtained by making incisions in the trunk of *Myroxylon Toluifera*, *H. B. and K.*’

*Characters.*—Usually seen in yellowish-brown, hard, brittle, somewhat translucent pieces, with a fragrant and characteristic odour, and an agreeable slightly aromatic taste. It is soft and tenacious when first imported, but becomes hard and brittle by keeping. Thin laminæ are transparent and show under the microscope numerous crystals. It is very slightly soluble in water; readily soluble in alcohol or chloroform. The alcoholic solution has an acid reaction.

A test is given in the Pharmacopœia to show the presence of a sufficient proportion of benzoates and cinnamates.

*Constituents.*—Resin (about 80 per cent.); cinnamein (mainly benzyl benzoate—about 7 per cent.); cinnamic acid (12 to 15 per cent.).

The resin consists of tolu-resinotannol combined with cinnamic and to a much less extent benzoic acids. Cinnamein contains, in addition to benzyl benzoate, benzyl cinnamate and small quantities of other substances (see p. 532).

*Dose.*—5 to 15 grains.

*Pharmacology.*—It is stimulant and antiseptic, but is not employed externally. It has a pleasant aromatic taste and acts as a mild carminative in the stomach and intestines.

After absorption it stimulates the bronchial mucous membrane if relaxed, and acts as a mild diuretic. It also renders the urine somewhat antiseptic. It is used in the treatment of chronic bronchial affections and as a flavouring agent.

**Syrupus Tolutanus.**—Syrup saturated with balsam of tolu.

It is contained in *Mistura Ammoniaci*.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.* — It is a mild flavouring syrup, especially useful for cough medicines.

**Tinctura Tolutana.**—Contains 1 ounce of balsam of tolu in 10 fluid ounces.

It is used to make the tolu basis of lozenges.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Benzoini Composita.** See page 531.

#### PREPARED STORAX

**Styrax Præparatus.**—‘A balsam obtained from the trunk of *Liquidambar orientalis*, *Miller*, and purified by solution in ethylic alcohol, filtration, and evaporation of the solvent.’

*Characters.*—A brownish-yellow, somewhat translucent semi-liquid substance, with a characteristic agreeable odour and a balsamic taste.

When boiled with a solution of potassium bichromate and sulphuric acid it gives off an odour resembling that of essential oil of bitter almonds. It should contain no water.

*Constituents.* — Resinous matter; cinnamic acid; a volatile oil (about 1 per cent.).

The resin consists of  $\alpha$ - and  $\beta$ -storesinols free and combined with cinnamic acid; the oily liquid portion consists of phenyl-propyl cinnamic acid.

mate, benzyl and ethyl cinnamates, cinnamyl cinnamate, phenyl-ethylene, vanillin, &c.

About 20 per cent. of cinnamic acid can be obtained from storax.

*Pharmacology.*—Its action is similar to that of the two preceding balsams. It may be employed externally as an ointment for parasitic skin diseases or given internally for chronic bronchitis &c., but it is rarely used except as a constituent of—

**Tinctura Benzoini Composita.** See page 531.



## TARRY PRODUCTS

THESE are obtained from the destructive distillation of wood or coal without free access of air.

When wood undergoes this process three varieties of products distil over—(i.) gases (carbon monoxide, methane, &c.); (ii.) crude pyroligneous acid (chiefly acetic acid); (iii.) tarry products. Carbon and ash are left in the retort.

The composition of the tarry product varies with the kind of wood from which it is derived, but in all cases it consists chiefly of aromatic hydrocarbons (benzene, &c.) and phenols (phenol, cresol, guaiacol, &c.).

Coniferous trees yield much more tar than other trees, and one rich in guaiacol and similar substances.

*Pharmacological Action of Tarry Products.*—This is due in the main to the phenols they contain. Their action is therefore similar to that of carbolic acid and creosote, but is weaker, and is modified by the presence of other substances. They are antiseptic. When applied to the skin they stimulate or irritate according to the strength of the application. They also depress sensibility and allay irritation if present. The continued use of even weak tarry preparations often causes a papular or, more rarely, a pustular eruption ('tar acne').

Taken internally, they produce somewhat similar effects to creosote. The symptoms of poisoning seen after large doses are similar to those produced by carbolic acid.

The tarry preparations are used externally to relieve itching and as applications for chronic scaly skin diseases, especially chronic eczematous conditions and psoriasis. They may be used as lotions, liniments, ointments, plasters, or

soaps, or in rare instances applied pure. It is generally advisable to start with weak preparations (1 to 2 per cent. lotions, or 2 to 3 per cent. ointments), and gradually increase the strength.

Wood-tar, as pills or tar-water, has been given internally for chronic bronchitis and a few other conditions, but, although efficacious, it does not appear to possess any advantages over purer products.

## TAR

**Pix Liquida.**—‘A bituminous liquid, obtained from the wood of *Pinus sylvestris*, *Linn.*, and other species of *Pinus*, by destructive distillation. Known in commerce as Stockholm tar.’

*Characters.*—A dark-brown or almost black semi-liquid substance with a characteristic empyreumatic odour and taste. Slightly soluble in water; readily soluble in alcohol. Its solution in water has a pale-brown colour and an acid reaction.

Specific gravity, 1.02 to 1.15. Its aqueous solution gives a red colour with solution of ferric chloride. It should not require more than ten volumes of 90 per cent. alcohol for its complete solution.

*Constituents.*—Aromatic hydrocarbons (benzene, toluene, xylene, naphthalene, terpenes, &c.), phenols (phenol, cresol, guaiacol, creosol and allied substances, pyrocatechin), pyroligneous (crude acetic) acid, in small quantity; pitchy residue.

**Unguentum Picis Liquidæ.**—Consists of tar, 5; yellow beeswax, 2.

*Pharmacology.*—It is too powerful for common use, and is too stiff for convenience. It may be applied, somewhat softened with almond oil, to very chronic eczematous patches, psoriasis, or chronic ringworm, but for most purposes it requires diluting with an ointment basis.

## PREPARED COAL TAR

**Pix Carbonis Præparata.**—‘Prepared by placing commercial coal tar in a shallow vessel, and maintaining it at a temperature of 49°C. for one hour, stirring frequently.’ This treatment is adopted to remove most of the ammonia present.

*Characters.*—A viscid blackish-brown liquid with a characteristic odour. Water agitated with it acquires an alkaline reaction (compare Pix Liquida and Oleum Cadinum).

*Constituents.*—Very numerous; mainly aromatic hydrocarbons and phenols.

When subjected to distillation the following products are obtained: (1) ‘light oil’ (3 to 5 per cent., mainly benzene and its near homologues); (2) ‘middle oil’ (10 to 20 per cent., mainly phenols and naphthalene); (3) ‘heavy or green oil’ (10 to 20 per cent., mainly anthracene); (4) pitchy residue (about 60 per cent.).

**Liquor Picis Carbonis.**—A solution of the alcohol-soluble ingredients of prepared coal tar in a strong tincture of quillaia bark.

It is prepared by digesting at 40°C. for two days, prepared coal tar 4 oz. in 20 fl. oz. of a 1-in-10 tincture of quillaia bark, and decanting or filtering.

*Pharmacology.*—The quillaia keeps the coal-tar oils in suspension when the preparation is added to water. Its action and uses are those of tar preparations generally.

## OIL OF CADE

**Oleum Cadinum**—juniper tar oil. ‘An empyreumatic oily liquid obtained by the destructive distillation of the woody portions of *Juniperus Oxycedrus*, *Linn.*, and some other species.’

*Characters.*—A dark reddish-brown or nearly black, somewhat viscid, oily liquid, with a characteristic agreeable empyreumatic odour and an empyreumatic, somewhat bitter and acrid, taste. Slightly soluble in water; partially soluble in

alcohol ; readily soluble in ether or chloroform. Its aqueous solution, if filtered, is almost colourless, and has an acid reaction.

Specific gravity about 0.990.

*Constituents.*—Similar to those of wood tar. It contains considerable quantities of a sesquiterpene, cadinene.

*Pharmacology.*—It is a somewhat pleasanter preparation than wood tar ; its action and uses are the same.



## FIXED OILS, FATS, AND ALLIED SUBSTANCES

THE chemical composition of these has already been described (page 9). For the most part they are bland substances with no pharmacological action beyond a protective and emollient one, although when taken internally (with the exception of the waxes) they are absorbed and act the part of foods. They are employed mainly as solvents, diluents, and emollients, being especially largely used as ointment bases.

Three exceptions require notice: cod-liver oil is mainly employed as a food, castor oil and croton oil are purgatives, the latter being powerfully active. These exceptions will be considered first.

The position of croton oil in this group cannot be regarded as settled—the so-called croton-oleic acid being a mixture of substances—but it is most conveniently described here.

## CASTOR OIL AND CROTON OIL

Both oils are derived from seeds which, although not official, merit notice on account of their toxicological importance.

*Characters.*—Both seeds are ovoid in shape, but more or less flattened on one (ventral) surface. The seed coat is thin and brittle, and encloses an oily endosperm, which further encloses two papery cotyledons (easily seen by carefully dividing longitudinally) and an embryo.

Castor seeds have a glossy and usually a marbled appearance (reddish-brown or black patches and stripes on a grey background); at one end they show a prominence (the caruncle).

Croton seeds are of a dull, uniform, cinnamon-brown colour, but may be slightly marked by friction, and usually



FIG. 116.

(a) Castor seeds, showing marbled appearance and caruncle; the right-hand seed has been divided longitudinally to show one of the papery cotyledons. (b) Croton seeds. Natural size.

show no caruncle (this having been broken off). The dorsal and ventral surfaces are separated by distinct lateral ridges.

*Chief Constituents.*—Of castor seeds: the official fixed oil (about 50 per cent.); a toxalbumin, ricin, occurring only in the seed coats.

Of croton seeds: the official fixed oil (about 50 per cent.); a toxalbumin, crotin, in the seed coats.

From the seed-coats of castor seeds a substance, ricinine, which has been regarded as an alkaloid, but which appears to be the dimethyl ester of a complex acid, ricinic acid, has been obtained.

Both ricin and crotin are powerfully poisonous substances, ricin being the more powerful of the two —  $\frac{1}{25,000,000}$  of the body weight is toxic. Castor seeds are consequently poisonous; one seed has produced serious symptoms, and two seeds have proved fatal.

Croton seeds are less poisonous, although croton oil is much more powerful than castor oil, because the toxalbumin crotin contained in them is less active than ricin.

In the official oils neither ricin nor crotin is present.

## CASTOR OIL

**Oleum Ricini.**—‘The oil expressed from the seeds of *Ricinus communis*, *Linn.*’

*Characters.*—A colourless, or almost colourless, viscid oil, with a very faint odour, and a taste which is at first bland,

but afterwards somewhat acrid and nauseous. It thickens on exposure to the air. Miscible, in all proportions, with absolute alcohol, ether, chloroform, and oil of turpentine.

Specific gravity, 0.950 to 0.970. It should not contain cotton-seed oil or other fixed oil.

*Constituents.*—Ricin-olein, a mixture of glyceryl ricin-oleate and glyceryl ricin-isoleate.

Stearin is present in very small quantity. Ricin-oleic acid is, like oleic acid, an unsaturated acid, and appears to be a hydroxyl derivative of oleic acid.



Ricin-oleic Acid

*Dose.*—1 to 8 fluid drachms.

*Pharmacology.*—Externally applied, castor oil is, like most other fixed oils, protective and emollient. Taken by the mouth, it produces, after moderate doses, purgation, usually unaccompanied by griping, in 5 or 6 hours.

Its action is dependent on the fact that while ricin-olein (glyceryl ricin-oleate) is bland and unirritating, ricin-oleic acid and its alkali salts are fairly powerfully irritating. Thus, although good specimens of castor oil are almost tasteless at first, they become acrid and unpleasant very quickly in the mouth, owing to slight decomposition by the saliva. On the stomach castor oil has practically no action, but, when it reaches the intestine, it is gradually saponified by the intestinal juices, and the alkali ricin-oleate produced stimulates the intestinal walls and purgation results.

Unpleasant effects are rarely produced by castor oil. Its unpleasant taste, which is nauseating to some people, is its greatest drawback.

It is the safest and most efficient laxative we possess, and is used largely as such, especially for children. Adults will rarely take it. It may be used whenever it is desirable to empty the intestinal tract. It is commonly used to remove undigested matter which may be causing diarrhoea, for which purpose it is often combined with a small quantity of tincture of opium. Its tendency to produce slight after-constipation is of benefit in this condition. Castor oil is not employed for

habitual constipation, nor is it of use when large watery evacuations are required.

It is applied as a protective to the eye after the extraction of foreign bodies, mainly on account of its viscosity. It is also given occasionally as an enema to soften faecal masses in the rectum, but it possesses no distinct advantages over other oils.

**Mistura Olei Ricini.**—An emulsion containing 3 fluid ounces of castor oil in 8 fluid ounces.

Castor oil, 3 fl. oz.; mucilage of gum acacia,  $1\frac{1}{2}$  fl. oz.; orange-flower water of commerce, 1 fl. oz.; cinnamon water,  $2\frac{1}{2}$  fl. oz.

*Dose, as a draught.*—1 to 2 fluid ounces.

*Pharmacology.*—It is a moderately pleasant method of taking castor oil, but might be improved.

Castor oil is a constituent of Collodium Flexile, Linimentum Sinapis, and Pilula Hydrargyri Subchloridi Composita.

## CROTON OIL

**Oleum Crotonis.**—‘The oil expressed from the seeds of *Croton Tiglium*, *Linn.*’

*Characters.*—A brownish-yellow to dark reddish-brown viscid oil, with an unpleasant odour and an acrid burning taste. Insoluble in water. Miscible with  $1\frac{1}{2}$  volumes or less of absolute alcohol, the addition of more up to 17 volumes yielding a turbid mixture; miscible, in all proportions, with ether, chloroform, olive oil, or oil of turpentine.

Specific gravity, 0.940 to 0.960. A test is given in the Pharmacopœia to prove the absence of other non-drying oils.

*Active Principle.*—Not definitely known. It has been ascribed most recently to a resinous substance, croton-resin, which is probably a lactone or anhydride of complicated structure. The oil is usually said to consist of glyceryl croton-oleate and croton-oleic acid.



Croton-resin,  $C_{13}H_{18}O_4$ , is a hard, pale-yellow, brittle resin, fluid at  $90^{\circ}C.$ , nearly insoluble in water, but soluble in alcohol, ether, and chloroform.

*Dose.*— $\frac{1}{2}$  to 1 minim.

*Pharmacology.*—Applied to the skin it acts as a powerful irritant, producing redness in 10 to 30 minutes, vesicles in 12 to 24 hours, and, later, pustules, which may become blood-stained. Taken by the mouth in 1-minim doses, it has an acrid burning taste, produces, after swallowing, an acrid sensation in the throat which may last for hours, a feeling of warmth in the stomach, and even of sickness, and, later, abdominal pain and diarrhœa. A motion is passed usually about 2 hours after taking the drug, and is generally followed by several copious evacuations during the succeeding 12 to 24 hours. Doses of 5 or 6 minims may produce severe gastro-enteritis.

The mode of action of croton oil is usually said to be the same as that of castor oil. Thus glyceryl eroton-oleate is inactive, but when saponified and converted into an alkali eroton-oleate, it becomes powerfully irritant. The crude oil is irritant because it contains free eroton-oleic acid. This theory explains the belief that eroton oil becomes more irritant by keeping, but does not well explain the fact that different samples of eroton oil vary in activity.

Croton oil is but little used. It was employed formerly as a counter-irritant in pleurisy, bronchitis, phthisis, meningitis, and other conditions. It is given occasionally as a purgative to maniacal or unconscious patients (*e.g.* cerebral hæmorrhage) when a purgative action is required, on account of its rapid effect and ease of administration. It has also been used as a purgative in lead colic, but is not a desirable remedy.

**Linimentum Crotonis.**—Consists of croton oil 1, oil of cajuput  $3\frac{1}{2}$ , alcohol (90 per cent.)  $3\frac{1}{2}$ , by volume.

*Pharmacology.*—It produces decided irritation, and may induce severe inflammation. It is used occasionally as a counter-irritant in sciatica, painful joints, and pulmonary affections.

## COD-LIVER OIL

**Oleum Morrhuæ.**—‘The oil extracted from the fresh liver of the cod, *Gadus Morrhua*, *Linn.*, by the application of a temperature not exceeding 82°C., and from which solid fat has been separated by filtration at about -5°C.’

*Characters.*—A pale-yellow mobile oil, with a characteristic slightly fishy odour and taste. Slightly soluble in alcohol (about 1 in 40) ; miscible in all proportions with ether and chloroform.

Specific gravity, 0.920 to 0.930. A drop of sulphuric acid added to a few drops of the oil produces a violet coloration (owing to the presence of cholesterin), which on stirring changes through purple to a dirty red. The oil kept at 0°C. for two hours should deposit no solid fat.

Cod-liver oil darkens in colour by keeping, and becomes rancid.

*Constituents.*—Two glycerides, jecolin and therapin.

Jecolin is a glyceride of jecolic acid ( $C_{19}H_{36}O_2$ ), and therapin a glyceride of therapic acid ( $C_{17}H_{34}O_2$ ), two acids concerning which little is known.

Cod-liver oil also contains small quantities of cholesterin, bile acids, two alkaloids (aselline and morrhaine), and glycerides of some lower fatty acids.

*Dose.*—1 to 4 fluid drachms.

*Pharmacology.*—The action of cod-liver oil is that of an easily assimilable fat, and it is used mainly in rickets, tuberculosis (especially of the lungs), osteo-arthritis, chronic bronchitis, and defective nutrition generally. It should be given about half an hour after meals in doses of one to two teaspoonfuls. Larger doses are apt to produce nausea in many people, and also diarrhoea. It is commonly given as an emulsion, the combination with malt extract being one of the best forms.

## ALMOND OIL

**Oleum Amygdalæ.**—‘The oil expressed from the bitter or sweet almond.’

*Characters.*—A pale-yellow oil, almost odourless, with a slight nutty oily taste. Soluble in 35 parts of alcohol ; miscible in all proportions with ether and chloroform.

Specific gravity, 0·915 to 0·920. It should not congeal until cooled to nearly  $-20^{\circ}\text{C}$ ., and should contain no peach-kernel or other fixed oil.

*Constituents*.—Olein (76 per cent.) ; palmitin and stearin (24 per cent.).

*Pharmacology*.—It has the action of a bland oil. It is less liable than olive oil to become rancid, and, being lighter in colour, forms whiter ointments.

It is the solvent in *Oleum Phosphoratum*, and is an ingredient of *Linimentum Ammoniae*, *Unguentum Aquæ Rosæ*, and *Unguentum Cetacci*.

### OLIVE OIL

**Oleum Olivæ**.—‘The oil expressed from the ripe fruit of *Olea europæa*, *Linn.*’

*Characters*.—A pale-yellow or greenish-yellow mobile oil, with a faint odour and bland oily taste. Slightly soluble in alcohol ; miscible in all proportions with ether and chloroform. It begins to congeal at  $10^{\circ}\text{C}$ ., and at  $0^{\circ}\text{C}$ . forms a nearly solid granular mass.

Specific gravity, 0·914 to 0·919. It should contain no cotton-seed oil. It is sometimes adulterated with other inferior oils.

*Constituents*.—Olein (about 70 per cent.) ; palmitin and arachidin.

Small quantities of linolein, cholesterin, free fatty acid, and chlorophyll.

*Pharmacology*.—It has the action of a bland oil. It is more liable than almond oil to turn rancid.

It is an ingredient of *Linimentum Ammoniae*, *Linimentum Calcis*, *Linimentum Camphoræ*, *Unguentum Capsici*, *Unguentum Hydrargyri Compositum*, *Unguentum Hydrargyri Nitratis*, *Unguentum Resinæ*, and *Emplastrum Picis* ; and is used in preparing the two mercury plasters, lead plaster, and hard and soft soaps.

### LINSEED

Linseed owes its usefulness largely to the fixed oil which it contains, and it may therefore be described here.

**Linum.**—‘The dried ripe seeds of *Linum usitatissimum*, *Linn.*’

*Characters.*—Dark-brown, glossy, flattish seeds, ovate in outline, rounded at one end, obliquely pointed at the other, and showing a slight depression on one side near the pointed extremity. They vary in length from  $\frac{1}{6}$  to  $\frac{1}{4}$  inch. Examined under a lens they are seen to be minutely pitted. They have a characteristic oily mucilaginous taste, but no distinctive odour.

A section examined under a lens shows them to consist of the seed-coat encircling a narrow oily endosperm which encloses two oily cotyledons.

*Chief Constituents.*—The official fixed oil (30 to 40 per cent.) ; mucilage, in the seed-coat.

The seeds also contain proteid (25 per cent.) and unimportant substances, and small quantities of a cyanogenetic glucoside, linamarin, of no pharmacological importance.

*Pharmacology.*—An infusion is used as a domestic remedy for pharyngeal and bronchial catarrh. It is mainly demulcent and owes most of its action to the dissolved mucilaginous constituents of the seed-coats.

**Linum Contusum**—crushed linseed. ‘Linseed reduced to coarse powder.’ It should contain all the oil.

*Characters.*—A coarse yellowish powder speckled with brown, oily to the touch, with a slight characteristic odour and a bland oily taste. It should be recently prepared.

It should contain not less than 30 per cent. of oil, no starch, and should not yield more than 5 per cent. of ash.

*Pharmacology.*—It is used almost solely for making poultices. The action of these is that of moist heat, but crushed linseed possesses the advantages of retaining its heat for some considerable time and, on account of the oil it contains, not caking or adhering fast to the skin. It should be ordered as crushed linseed and not linseed meal, which is a finer powder and contains only about one-fourth the quantity of oil.



**Oleum Lini.**—‘The oil expressed from linseed at ordinary temperatures.’

*Characters.*—A nearly colourless to pale brownish-yellow viscid oil with a characteristic odour and bland oily taste. Soluble in 30 parts of alcohol; miscible in all proportions with ether, chloroform, and oil of turpentine. When exposed to the air, it thickens, and if in thin layers dries to a transparent varnish.

Specific gravity, 0.930 to 0.940. It should not congeal above  $-20^{\circ}\text{C}$ .

*Constituents.*—Linolein; small quantities of olein, palmitin, stearin, and myristin.

Linolein is glyceryl linolate, which is apparently a mixture of glyceryl linolate, linolenate, and isolinolenate. Its most important characteristic is its power of absorbing oxygen from the air and forming a hard varnish.

*Pharmacology.*—It has the action of a bland oil, but is very little used. Mixed with an equal volume of solution of lime, it forms the so-called carron oil, which has been used largely as an application to recent scalds and burns.

#### OIL OF THEOBROMA

**Oleum Theobromatis**—cacao butter. ‘A concrete oil obtained by pressing the warm crushed seeds of *Theobroma Cacao*, *Linn.*’

*Characters.*—A yellowish-white solid, unctuous to the touch, with an odour resembling that of cocoa, and a bland agreeable taste. It is seen usually in bars which break with a smooth fracture. It softens at  $26^{\circ}\text{C}$ . and melts at a temperature between  $31^{\circ}$  and  $34^{\circ}\text{C}$ .

The Pharmacopœia gives a test to prove the absence of other fats.

*Constituents.*—Stearin (nearly 50 per cent.); palmitin; laurin.

Small quantities of arachidin and the glyceryl esters of some of the lower fatty acids are present.

*Pharmacology*.—Its action is that of a bland oil. It is used only as a basis for suppositories, for which purpose it is well adapted on account of its being solid at ordinary temperatures and melting below the temperature of the body. It is the basis of all the suppositories of the Pharmacopœia except glycerin suppository.

## LARD

**Adeps.**—‘The purified fat of the hog, *Sus scrofa*, *Linn.*’

*Characters*.—A soft, white, fatty substance, with a slight characteristic odour and taste. It melts at about 38°C. and forms a clear liquid without any rancid odour.

It should be neutral to litmus, dissolve entirely in ether, and should contain no sodium chloride, starch, or cotton-seed oil, and not more than a trace of fatty acid.

*Constituents*.—Olein (about 60 per cent.), palmitin, and stearin (about 40 per cent.).

*Pharmacology*.—Its action is that of a bland oil. It is used in therapeutics as an ointment basis, rarely as a pill excipient.

It is contained in Emplastrum Cantharidis, Pilula Phosphori, and in eight ointments (or, including those made from benzoated lard, twenty ointments) of the Pharmacopœia.

**Adeps Benzoatus.**—Lard containing a small quantity of the benzoic acid and some other ingredients of benzoin.

Prepared by heating 500 parts of lard and 15 parts of powdered benzoin on a water-bath for two hours and afterwards straining, and stirring until cold to prevent crystallisation of the benzoic acid.

*Pharmacology*.—It keeps better than pure lard, and is consequently more generally used as an ointment basis. It is, however, slightly irritant, and is therefore not a good basis for ointments to be applied to sensitive mucous membranes such as the conjunctiva.

## PREPARED SUET

**Sevum Præparatum.**—‘The internal fat of the abdomen of the sheep, *Ovis Aries*, *Linn.*, purified by melting and straining.’

*Characters.*—White, smooth, slightly unctuous to the touch, and almost odourless. It melts between  $44.5^{\circ}$  and  $49^{\circ}\text{C}$ . and commences to re-solidify at about  $38^{\circ}\text{C}$ .

Insoluble in alcohol (slightly soluble in boiling alcohol), slightly soluble in ether, readily soluble in petroleum ether.

*Constituents.*—Stearin and palmitin (about 80 per cent.) ; olein (about 20 per cent.).

*Pharmacology.*—It is used to increase the consistence of otherwise too diffuent ointments.

It is contained in Unguentum Hydrargyri.

## WOOL FAT

This is official in an anhydrous and a hydrous form. The anhydrous is somewhat translucent, the hydrous is opaque.

**Adeps Lanæ.**—‘The purified cholesterin-fat of sheep’s wool.’

Wool yields about 10–15 per cent., but may yield as much as 30 per cent.

*Characters.*—A yellowish tenacious, somewhat translucent, unctuous substance, with a very slight odour and a bland taste. Sparingly soluble in alcohol, readily in ether or chloroform. It will mix with its own weight of water.

It melts at from  $40^{\circ}$  to  $44.5^{\circ}\text{C}$ . If to a solution in chloroform sulphuric acid is carefully added the upper chloroformic layer becomes after a few minutes of a dark-red colour. It should contain no nitrogenous animal matter, and not more than a trace of free fatty acid, and should yield not more than 0.3 per cent. of ash, which should not be alkaline.

*Constituents.* — Cholesterin ; ischolesterin ; and their esters (mainly palmitate and stearate).

*Pharmacology*.—It is a bland unctuous substance. It penetrates the skin better than any other ointment basis, and is consequently employed when it is desired to rub a medication well into the skin. It is too tenacious to be used alone, and is therefore combined with almond oil or other fatty oil, or with soft vaseline. Such a mixture rubbed into the skin softens it and increases its elasticity. Wool fat does not become rancid.

**Adeps Lanæ Hydrosus**—lanolin. Consists of wool fat, 7 ounces ; distilled water, 3 fluid ounces.

*Characters*.—Similar to those of wool fat. It is more opaque, and when melted separates into an upper oily and a lower aqueous layer. The whole of the water can be driven off by heating it on a water-bath.

It is the basis of Unguentum Conii and Unguentum Hamamelidis.

*Pharmacology*.—Its action is the same as wool fat. It is of somewhat greater consistence and consequently must be diluted with soft vaseline, fatty oil, or some other diluent. It is used as an ointment basis, especially for substances in aqueous solution.

## WAXES

This includes yellow beeswax and the bleached form, white wax, and spermaceti. They are all firm, stable, solid substances, and are employed mainly to modify the consistence of other substances and render them suitable for external application. They are not absorbed by the skin or the alimentary tract. White wax is occasionally used as a pill-excipient for oxidising and readily oxidisable substances, but on account of its high melting-point and insolubility in the alimentary fluids it is not suitable for use alone.

**Cera Flava**—yellow beeswax. ‘Prepared from the honeycomb of the Hive Bee, *Apis mellifica*, *Linn.*’

*Characters*.—A firm, dull yellow substance with an agreeable honey-like odour. It breaks with a granular fracture.



Soluble in hot oil of turpentine, partially soluble in ether, but insoluble in alcohol, water, or boiling caustic soda solution.

Melting-point, 62.5° to 64°C.; specific gravity, 0.960 to 0.970. It should not contain soluble fatty acids, resin, Japan wax, paraffins, or starch.

*Constituents*.—Myricin or myricyl palmitate (80 per cent. or more); cerotic acid (about 15 per cent.).

Traces of other substances—cerolein, heptacosane, hentriacontane, colouring matter, &c.—occur.

It is a constituent of Emplastrum Calcificans, Emplastrum Cantharidis, Emplastrum Menthol, Emplastrum Picis, Unguentum Hydrargyri Compositum, Unguentum Picis Liquidæ, Unguentum Resinæ, and Unguentum Staphisagriæ.

**Cera Alba**—white beeswax. ‘Yellow beeswax which has been bleached by exposure to moisture, air, and light.’

*Characters*.—Nearly white, somewhat translucent, and odourless, but otherwise similar to yellow beeswax. It is seen usually in thin circular cakes.

It is contained in Pilula Phosphori, Suppositoria Acidi Carbolici, Unguentum Aquæ Rosæ, and Unguentum Cetacci.

**Cetaceum**—spermaceti. ‘A concrete fatty substance, obtained, mixed with oil, from the head of the sperm whale, *Physeter macrocephalus*, *Linn.* It is separated from the oil by filtration and pressure, and is afterwards purified.’

*Characters*. — Translucent, pearly - white, crystalline masses, slightly unctuous to the touch, without distinctive taste or odour. Insoluble in water; nearly insoluble in alcohol; soluble in ether, chloroform, and in fixed and volatile oils. It can be powdered by the aid of a little alcohol.

Melting-point, 46° to 50°C. It should not contain stearic acid.

*Constituents*.—Cetyl palmitate; traces of other similar esters.

**Unguentum Cetacei**.—Consists of spermaceti, white beeswax, and almond oil, impregnated with benzoin.

Spermaceti 20, white beeswax 8, almond oil 72, are melted together. Benzoin in coarse powder, 2, is added, and the heating continued for two hours; strain; stir until cold.

*Pharmacology.*—It has merely a protective action and may be used as an ointment basis. The soluble ingredients of the benzoin make it slightly irritating to sensitive mucous membranes, and it is consequently not adapted for eye ointments.

Cetaccum is an ingredient of Unguentum Aquæ Rosæ and Unguentum Capsici.

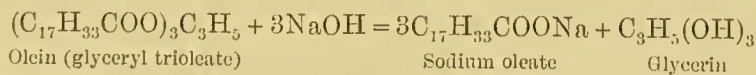
## SOAPS

The Pharmacopœia contains three soaps—curd soap, hard soap, and soft soap—besides lead soap (Emplastrum Plumbi) which does not belong, pharmacologically, to this group, and has been described elsewhere.

*Pharmacology.*—The action of soaps is dependent almost solely on the fact that in aqueous solution they produce by hydrolysis a small concentration of free hydroxyl-ions. Their action, therefore, is that of a weak alkali. When applied to the skin they soften the epidermis and act as cleansing agents. In virtue of the alkalinity and the viscosity of their solutions they are able to emulsify substances, and on account of their cohesiveness are able to bind together insoluble powders. They are used for both these purposes in some of the official liniments and pills.

When taken by the mouth they have an unpleasant characteristic taste and act as mild alkalies on the alimentary tract. Moderate doses, taken repeatedly, are laxative; large doses produce nausea and vomiting.

Soaps are made by saponifying oils or fats with caustic alkali solutions (pages 9, 10); an alkali salt (oleate, stearate, &c.) and glycerin are formed.



The soap in most cases is 'salted out,' and is purified by successive solutions in hot water and 'salting out.' The glycerin and impurities (carbonates, &c.) are thus left in the mother liquor. Soft soap (potassium oleate) cannot be purified in this way, as double decomposition would occur between the potassium oleate and the common salt, and sodium oleate would be formed. Soft soap, therefore, contains the glycerin

formed during its preparation, and it is also liable to contain small amounts of potassium hydroxide and carbonate.

**Sapo Animalis**—curd soap. Mainly sodium stearate with about 30 per cent. of water.

Prepared from sodium hydroxide and a purified animal fat consisting mainly of stearin.

*Characters.*—White or nearly white, dry, and almost odourless. Sparingly soluble in water, more soluble in alcohol; readily soluble in boiling water or boiling alcohol. It may be moulded if warmed, and if dried can be powdered.

It should contain not more than 0·3 per cent. of sodium carbonate and no unsaponified fat.

It is a constituent of *Extractum Colocynthis Compositum*, *Lini-mentum Potassii Iodidi cum Sapone*, and *Pilula Scammonii Composita*.

*Pharmacology.*—On account of its small solubility in water it has a very mild action. It may be employed for the same purposes as hard soap, but is not so generally useful.

**Sapo Durus**—hard soap. Mainly sodium oleate, with about 30 per cent. of water.

Prepared by saponifying olive oil with sodium hydroxide.

*Characters.*—Greyish-white, dry, and almost odourless. Soluble in 20 parts of cold water or alcohol. It may be moulded if warmed, and if dried can be powdered.

It should not contain more than 0·3 per cent. of sodium carbonate.

*Pharmacology.*—See page 553. It is used chiefly as an excipient for pills, especially those containing vegetable powders, and as an auxiliary and emulsifying agent for liniments and lotions. A suppository moulded from soap is often beneficial in the treatment of constipation in children.

### **Emplastrum Saponis.**

Hard soap, 6; lead plaster, 36; resin, 1. It is an ingredient of *Emplastrum Calefaciens* and *Emplastrum Cantharidis*.

**Pilula Saponis Composita.**—See page 316.

Hard soap is a constituent of *Emplastrum Resinæ* and of six pills—*Pilula Aloes Barbadosensis*, *Pilula Aloes Socotrinæ*, *Pilula Aloes et*

Asafetidæ, Pilula Cambogiæ Composita, Pilula Rhei Composita, Pilula Seillæ Composita.

It is used in making Hydrargyri Oleas and Unguentum Zinci Oleatis.

**Sapo Mollis**—soft soap. Mainly potassium oleate; it contains also glycerin and small amounts of potassium hydroxide and carbonate.

Prepared by saponifying olive oil with potassium hydroxide.

*Characters.*—A greenish or yellowish, somewhat translucent, semi-solid substance, with a slight characteristic odour. Soluble in four parts of cold water, and in less than its weight of alcohol.

It should not contain any copper compound or free oil, or more than 3 per cent. of matter (insoluble soaps, potassium carbonate) insoluble in warm alcohol.

*Pharmacology.*—It is more powerful than the two preceding soaps, both on account of its greater solubility in water and the presence of potassium carbonate. Applied to the skin it produces the effect of an alkali (see page 112) and is sometimes employed as a paste in the treatment of chronic skin diseases with thickened epidermis. Dissolved in water ( $\frac{1}{2}$ –1 oz. to a pint) it is used as an enema for constipation.

**Linimentum Saponis.**—An alcoholic solution containing 2 ounces of soft soap, 1 ounce of camphor, and a little oil of rosemary in 20 fluid ounces.

Soft soap, 2 oz.; camphor, 1 oz.; oil of rosemary, 3 fl. dr.; alcohol (90 per cent.), 16 fl. oz.; distilled water, 4 fl. oz.

*Pharmacology.*—It is a useful stimulating liniment of considerable service in the treatment of bruises, sprains, muscular pains, &c.

It is contained in Linimentum Opii.

Soft soap is the emulsifying agent in Linimentum Terebinthinæ.



## GUMS, STARCH, GELATIN, &amp;c.

THESE substances have no marked pharmacological action, and are conveniently grouped together. They are mainly demulcent and protective, and are used chiefly as auxiliary substances in the administration of medicines.

## GUM ACACIA

**Acaciæ Gummi.**—‘A gummy exudation from the stem and branches of *Acacia Senegal*, *Willd.*, and of other species of *Acacia*, *Willd.*’

*Characters.*—Rounded or ovoid tears or fragments of tears, separate or united into masses. The tears are colourless, or, more usually, slightly yellowish, opaque, owing to the presence of minute external fissures, and brittle. The fractured surface has a vitreous appearance. The taste is bland and mucilaginous. Readily soluble in water; insoluble in alcohol. The solution in water has a very faint acid reaction.

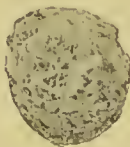


FIG. 117.  
A tear of Gum  
Acacia. Natural size.

Inferior varieties of gum acacia are excluded by the tests prescribed by the Pharmacopœia. On incineration it should not yield more than 4 per cent. of ash.

*Constituents.*—Arabin (see page 15).

Traces of sugar and other substances. Moisture (12 to 17 per cent.).

*Pharmacology.*—It is demulcent, and as an ingredient of lozenges, mixtures, &c., helps to allay irritation in the mouth and throat. On account of its viscosity it diminishes the

taste of substances. It is employed chiefly as an emulsifying and suspending agent, usually in the form of the mucilage.

**Mucilago Acaciæ.**—A solution of 2 ounces of gum acacia in 3 fluid ounces of distilled water.

It is slightly acid, and becomes more so by keeping. It should therefore be freshly prepared. With strong solutions of borax it forms a translucent jelly, and with solution of lead subacetate an opaque white jelly.

Gum acacia is an ingredient of **Pulvis Amygdalæ Compositus** and **Pulvis Tragacanthæ Compositus**. Both the gum and the mucilage are used in making **Trochisci**. The mucilage is the emulsifying agent in **Mistura Olei Ricini**.

#### TRAGACANTH

**Tragacantha.**—‘A gummy exudation obtained by incision from *Astragalus gummifer*, *Labill.*, and some other species of *Astragalus*, *Linn.* Known in commerce as Syrian tragacanth.’

*Characters.*—White or slightly yellowish, translucent, horny, thin flakes, usually curved or more or less contorted, and marked on the surface by concentric ridges. The pieces vary in size, but are commonly about 1 inch long and  $\frac{1}{2}$  inch wide. It is odourless and almost tasteless. In water it swells into a gelatinous mass, but is partially soluble. It is insoluble in alcohol.



FIG. 118.

The surface of a piece of Tragacanth, showing concentric ridges. Natural size.

*Constituents.*—Bassorin or tragacanthin (60 to 70 per cent.) ; arabin (8 to 10 per cent.).

Small amounts of starch, nitrogenous and other substances occur.

*Pharmacology.*—It is used to suspend insoluble powders, as an emulsifying agent, and to give adhesiveness to pill masses.

**Mucilago Tragacanthæ.**—Contains 6 grains of tragacanth in 1 fluid ounce.

Powdered tragacanth, 60 gr. ; alcohol (90 per cent.), 2 fl. dr. ; distilled water to make 10 fl. oz.

The alcohol serves the purpose of wetting and separating the fine particles of tragacanth, thus enabling the water to act on each. If water is added to dry powdered tragacanth, lumps are formed, not a mueilage.

It is contained in Lotio Hydrargyri Nigra and serves to suspend the precipitated black oxide.

**Glycerinum Tragacanthæ.**—A translucent, pasty, tenacious mass.

Powdered tragacanth,  $\frac{1}{2}$  oz. ; glycerin,  $1\frac{1}{2}$  fl. oz. ; distilled water,  $\frac{1}{2}$  fl. oz.

*Pharmacology.*—It is used as a pill excipient.

**Pulvis Tragacanthæ Compositus.**—Consists of tragacanth 1, gum acacia 1, starch 1, sugar 3.

*Dose.*—20 to 60 grains.

*Pharmacology.*—It is a demulcent powder, but is used chiefly as a suspending and emulsifying agent.

Tragacanth is contained in Confectio Sulphuris, Mistura Cretæ, Mistura Guaiaci, Pilula Ferri, Pilula Quininae Sulphatis, Pulvis Opii Compositus.

## STARCH

**Amylum.**—‘The starch procured from the grains of common wheat, *Triticum sativum*, *Lam.* ; maize, *Zea Mays*, *Linn.* ; and rice, *Oryza sativa*, *Linn.*’

*Characters.*—White, angular or columnar masses or white powder, without odour or taste. When boiled with water it forms a mucilage, which, if sufficiently thin, separates on standing for 24 hours into an upper almost clear layer, and a lower more opaque layer ; it gives, with iodine solution, a deep-blue colour, which disappears on heating and reappears on cooling. The microscopical characters are shown in the figures.

Starch should be free from all other kinds of starch granules or other granules. It should also show no acidity or alkalinity when triturated with a little cold water.

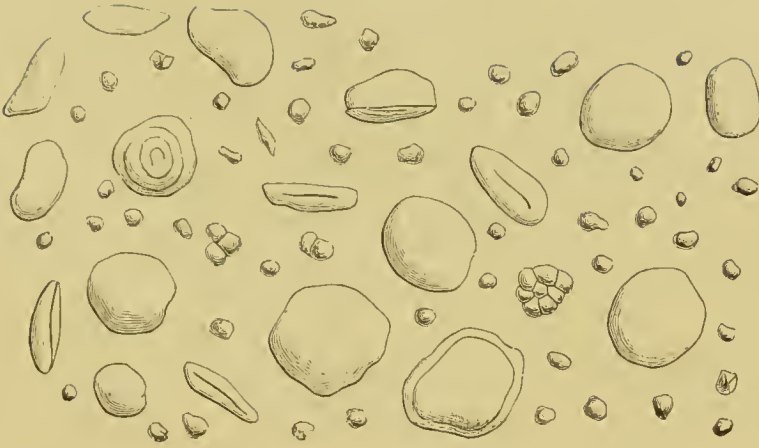


FIG. 119.

Wheat Starch, showing mixture of large and small granules. The large granules generally show very faint concentric striae and a central hilum (seen in one granule to left), and are somewhat lenticular in shape.  $\times 300$  (after Tschirch).

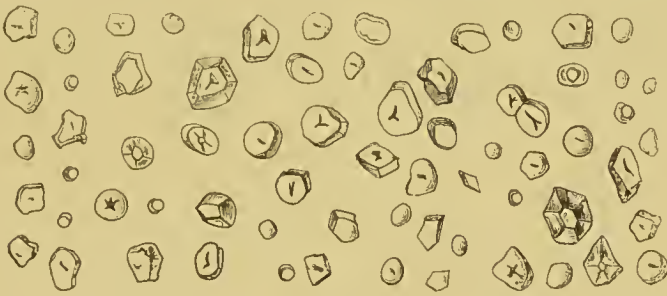


FIG. 120.

Maize Starch, showing somewhat polygonal granules with a distinct hilum; fairly uniform in size, and smaller than the larger granules of wheat starch.  $\times 300$  (after Tschirch).

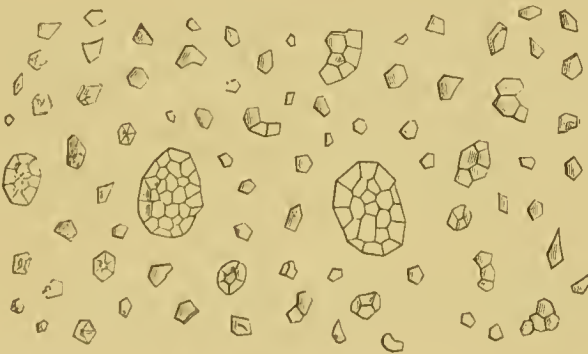


FIG. 121.

Rice Starch, showing very minute polygonal granules without distinct hilum; nearly uniform in size, but often appearing united into larger or smaller masses.  $\times 300$  (after Tschirch).



*Pharmacology.*—It is a food, but therapeutically it is employed chiefly as a drying powder in skin diseases, and to prevent chafing of two opposing surfaces. Violet powder, which is so largely used for children, is perfumed starch powder. Mucilage of starch is employed as an enema for diarrhœa due to inflammation of the lower part of the intestinal tract.

**Glycerinum Amyli.**—A translucent jelly.

Starch, 1 oz. ; glycerin,  $6\frac{1}{2}$  fl. oz. ; distilled water,  $1\frac{1}{2}$  fl. oz. ; heated together.

*Pharmacology.*—It has the same action as glycerin, but is somewhat milder. It may be used externally for the same purposes as glycerin ; it is a useful application, for example, to chapped hands.

**Pulvis Tragacanthæ Compositus.**—See page 558.

## GELATIN

**Gelatinum.**—‘The air-dried product of the action of boiling water on such animal tissues as skin, tendons, ligaments, and bones.’

*Characters.*—Almost colourless, translucent sheets or shreds, without odour, and almost without taste. It swells up in cold water and dissolves in hot water, the hot liquid resetting to a jelly if the strength of the solution is 2 per cent. or more. It is soluble in acetic acid, but insoluble in alcohol and most other organic solvents. An aqueous solution is precipitated by a solution of tannic acid.

It is the basis of Suppositoria Glycerini and of all the official Lamellæ.

*Pharmacology.*—It is a food in the sense of being an albumen-sparer, but therapeutically it is used mainly as a basis of dermatological pastes, court-plasters, capsules, and lozenges (jujubes). For this purpose it is usually combined with glycerin. It is also employed to coat pills. Within recent years a sterilised solution has been injected hypo-

dermically for continued hæmorrhage of various kinds, and injected into the cyst as a cure for aneurism.

## COTTON

**Gossypium**—cotton wool. ‘The hairs of the seed of *Gossypium barbadense*, *Linn.*, and of other species of *Gossypium*, freed from fatty matter.’

*Characters*.—A soft, white, woolly substance, consisting of long filaments, without odour or taste. Insoluble in water, but readily wetted by it; soluble in a strong solution of copper ammonio-sulphate.

Microscopically each filament consists of an elongated cell, and appears as a flattened twisted band with slightly thickened rounded edges. It should possess no acidity or alkalinity, and after incineration should leave less than 1 per cent. of ash.

The official cotton is the so-called ‘absorbent cotton-wool.’ The natural cotton, after ‘carding,’ is boiled under pressure with dilute caustic soda solution to free it from fatty matter, and is subsequently bleached by means of chlorinated lime and hydrochloric acid.

*Constituents*.—It consists of almost pure cellulose.

It is used to make pyroxylin.

*Pharmacology*.—It is employed chiefly as a surgical dressing, generally medicated with some antiseptic, and for various other purposes.

## PYROXYLIN

**Pyroxylinum**—cellulose di-nitrate.

Prepared by immersing 1 oz. of cotton for three minutes in a mixture of 5 fl. oz. of sulphuric acid and 5 fl. oz. of nitric acid, washing until free from acid, and drying on a water-bath. The sulphuric acid acts as a dehydrating agent.

*Characters*.—It is similar in appearance to cotton, but is often slightly yellowish, is harsher to the touch, and burns with a flash when ignited, leaving no residue. It is soluble in a mixture of equal volumes of ether and 90 per cent. alcohol.

Cellulose mono-nitrate and tri-nitrate are not soluble in this mixture. It is used only to make the collodions.

**Collodium**—collodion. A solution of pyroxylin in a mixture of ether and alcohol.

Pyroxylin, 1 oz.; ether, 36 fl. oz.; alcohol (90 per cent.), 12 fl. oz.

*Characters*.—A colourless, syrupy liquid, smelling strongly of ether, and quickly leaving, when exposed in a thin layer to the air, a thin transparent pellicle, which contracts on drying further, and is insoluble in water or alcohol.

*Pharmacology*.—The film which it leaves after applying to the skin is protective, but, as it is somewhat brittle, flexible collodion is more commonly employed. It is a useful basis for applying some medicaments to the skin.

**Collodium Flexile**.—Collodion containing a small quantity of Canada turpentine and castor oil.

Collodion, 12 fl. oz.; Canada turpentine,  $\frac{1}{2}$  oz.; castor oil,  $\frac{1}{4}$  oz.

*Pharmacology*.—The film left on exposure to the air is less brittle, and has consequently less tendency to crack. The collodion may be painted on leech bites or other small fresh wounds, or whenever simple protection from the air is required. Its application to denuded surfaces causes transient pain.

**Collodium Vesicans**—blistering collodion. A solution of pyroxylin in blistering liquid.

Blistering liquid, 20 fl. oz.; pyroxylin,  $\frac{1}{2}$  oz.

*Pharmacology*.—Its action is similar to that of Emplastrum Cantharidis (see page 428).

## INDIA-RUBBER

**Caoutchouc**.—‘The prepared milk-juice of *Hevea brasiliensis*, *Muell. Arg.*, and probably other species; known in commerce as pure Para rubber.’

*Characters.*—The most important character is its elasticity. It occurs in masses of various sizes and varied appearance, sometimes in thin porous sheets. Usually the masses are brownish-black externally, and more or less mottled or striated with a paler tint internally. Some varieties have a yellowish-pink interior. It is insoluble in water and in alcohol, but soluble in chloroform, carbon bisulphide, petroleum ether, benzene, and oil of turpentine. Its somewhat empyreumatic odour and slight taste are characteristic.

It melts on heating to about 125°C., and if subsequently cooled forms an adhesive mass. If the heating is continued, it decomposes, and oil of caoutchouc distils over, which consists chiefly of a hemiterpene, isoprene.

Caoutchouc combines with sulphur to form vulcanised indiarubber and other similar products.

*Constituents.*—Hydrocarbons chiefly. It also contains albuminous matter, resin, volatile oil, fat, colouring matter, and mineral substances. Pure caoutchouc, a white amorphous substance, is regarded as a polyterpene.

It forms part of the basis of most commercial plasters. These plasters readily adhere even to the moist skin, and are more pliable than ordinary plasters.

**Liquor Caoutchouc.**—A solution of india-rubber in benzol and carbon bisulphide.

India-rubber, 1 oz.; benzol, 10 fl. oz.; carbon bisulphide, 10 fl. oz.

It is used only to prepare Charta Sinapis.



## LAXATIVE FRUITS

Four fruits are official in the Pharmacopœia merely to be used in making confection of senna, although raisins, an ingredient of compound tincture of cardamoms and compound tincture of senna, are not official.

Their action as laxatives is due chiefly to the sugar they contain. This, being associated with colloidal matter in the fruit, is not absorbed so rapidly as pure sugar, and consequently is enabled to exert a mild irritant action along the intestinal tract. It is aided in many cases by the salts and by the mechanical action of seeds present in the fruit. The fruits are also demulcent, but are not much used for this purpose.

## FIGS

**Ficus.**—‘The dried fleshy receptacles of *Ficus Carica*, Linn.’

*Characters.*—These are too well known to need description.

A fig is produced by the abnormal growth of a lateral shoot, which becomes pear-shaped and bears on its inner surface numerous flowers. As the fig ripens the fleshy wall becomes pulpy and sweet, and the flowers form the fruit, or so-called seed. After gathering, the figs are dried in the sun.

Two varieties of dried figs are recognised: ‘natural’ figs, which have been packed as gathered; ‘pulled’ figs, which are pressed and kneaded to make the skin translucent and tender.

*Chief Constituent.*—Grape sugar (60 to 70 per cent.).

**Confectio Sennæ.**—See page 403.

## PRUNES

**Prunum.**—‘The dried ripe fruits of *Prunus domestica*, *Linn.*, var. *Juliana*, *DC.*’

*Characters.*—Black, shrivelled, somewhat ovoid fruits, about  $1\frac{1}{4}$  inches long, containing a brownish pulp with a sweet acidulous taste, and an oval flattened stone in which is an almond-like seed having the taste of bitter almonds.

*Chief Constituents.*—A sugar (about 40 per cent.) ; vegetable acids (malic, tartaric, &c.) (2 to 3 per cent.).

**Confectio Sennæ.**—See page 403.

## TAMARINDS

**Tamarindus.**—‘The fruits of *Tamarindus indica*, *Linn.*, freed from the brittle outer part of the pericarp, and preserved with sugar.’



FIG. 122.

Tamarind fruit, with pericarp removed, taken from the tamarinds as imported. To the right are the seeds, the lower being enclosed in the tough endocarp.  $\frac{3}{4}$  linear.

*Characters.*—A reddish-brown moist sugary mass, containing strong branched fibres, and hard brown, shining,

somewhat ovoid or quadrangular seeds, each of which is enclosed in a tough skin or endocarp. It has an agreeable odour, and a sweet acid taste.

The pulp should give no characteristic reaction for copper.

*Chief Constituents.*—Tartaric acid (about 7 per cent.); citric acid (about 3 per cent.); acid potassium tartrate (about 5 per cent.). Added sugar (as a preserving agent).

*Pharmacology.*—They have an agreeable, decidedly acid taste, and consequently produce a mild acid action. The presence of pectin and mucilaginous substances in the pulp hinders the absorption of the acids, hence a moderate dose produces a laxative effect. Made into an infusion it forms an agreeable drink for feverish patients. As an ingredient of confection of senna it acts the part mainly of a flavouring agent.

**Confectio Sennæ.**—See page 403.

#### CASSIA PULP

**Cassiæ Pulpa.**—‘The pulp obtained from the pods of *Cassia Fistula*, *Linn.*’

*Characters.*—The ripe pods are imported, and the pulp, which alone is official, obtained from them as required. The pods are from  $1\frac{1}{2}$  to 2 feet in length, and  $\frac{3}{4}$  to 1 inch in diameter, hard, nearly smooth, straight, and cylindrical, chocolate-brown or blackish-brown in colour, and marked with fine transverse striations and a longitudinal suture along the dorsal and ventral surfaces. On longitudinal section the pod is seen to be divided into numerous divisions by septa, each division or cell containing stiff, nearly black



FIG. 123.

Nearly half of a cassia pod, showing longitudinal suture, fine transverse striations, and in the upper part the cells containing pulp, part of which has been removed to show the seeds.  $\frac{1}{2}$  linear.

pulp, and a smooth, hard, reddish-brown, flattened-ovoid seed. The pulp has a faint somewhat unpleasant odour, and a sweet characteristic taste.

*Chief Constituent*.—A sugar (about 60 per cent.).

The pods yield about 30 per cent. of pulp.

*Pharmacology*.—The pulp may be given as a laxative, but in some cases it has produced griping. It is rarely employed except as an ingredient of confection of senna.

**Confectio Sennæ**.—See page 403.



## DRUGS USED AS COLOURING AGENTS

## COCHINEAL

**Coccus.**—‘The dried fecundated female insect, *Coccus Cacti*, *Linn.*, reared on *Nopalea coccinellifera*, *Salm-Dyck*, and on other species of *Nopalea*.’

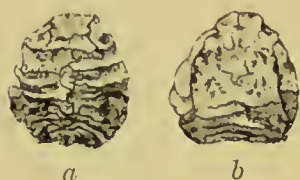


FIG. 124.

Cochineal, showing (a) dorsal and (b) ventral surfaces.  $\frac{3}{4}$  linear.

*Characters.*—About  $\frac{1}{5}$  inch long, somewhat oval in outline, convex and transversely wrinkled on the dorsal surface, flat or concave and irregularly wrinkled on the ventral surface; purplish-grey (silver-grain cochineal) or purplish-black (black-grain cochineal) in colour; easily reduced to a dark-red or puce-coloured powder.

If steeped in water the insects swell, and three pairs of legs can be detected on the ventral surface; the water is coloured reddish, but no insoluble powder should separate.

According to the mode of killing the insect, the waxy secretion naturally covering it is retained—‘silver-grain cochineal’—or is discharged—‘black-grain cochineal.’

*Chief Constituents.*—Carminic acid (about 10 per cent.).

The other ingredients are mainly fatty and albuminous substances.

Carminic acid may be obtained in red, prismatic crystals, soluble in water and in alcohol. Carmine is prepared by precipitating a decoction of cochineal with alum or other substance, the method varying somewhat in different manufactories.

**Tinctura Cocci.**—Contains the colouring matter of 1 ounce of cochineal in 10 fluid ounces.

*Dose.*—5 to 15 minims.

Cochineal is used in preparing *Tinctura Cardamomi Composita* and *Tinctura Cinchonæ Composita*.

## SAFFRON

**Crocus.**—‘The dried stigmas and tops of the styles of *Crocus sativus*, *Linn.*’

*Characters.*—A dark-red mixed with yellow felted mass, flexible and unctuous to the touch when fresh, with a characteristic aromatic odour and a bitter somewhat aromatic taste. When placed in water, it colours the water yellow, or if rubbed with a wetted finger stains it of an orange-yellow tint.

Saffron is composed of short yellow styles, each of which carries three orange-red tubular stigmas, about 1 inch in length, narrow below, but broadening towards the free extremity, which is slit on one side and notched.

Saffron is very liable to be adulterated; exhausted saffron may even be re-coloured by aniline dyes. It should not deposit any powder when placed in water, or deflagrate when incinerated, or yield an oily stain when pressed between filter papers. It should contain not more than  $12\frac{1}{2}$  per cent. of moisture, and should yield about 7 per cent. of ash.

*Chief Constituents.*—Polychroit, a colouring substance; a volatile oil; picrocrocin, a bitter principle.

Polychroit appears to be a complex ester; the volatile oil consists of terpenes and allied oxygenated compounds. Picrocrocin is a terpene-glucoside, yielding on hydrolysis a terpene and *d*-glucose.

*Pharmacology.*—It has, to some extent, the action of a volatile oil, but is used only as a colouring substance.

**Tinctura Croci.**—Contains the active ingredients of 1 ounce of saffron in 20 fluid ounces.

*Dose.*—5 to 15 minims.

Saffron is used in the preparation of Decoctum Aloes Compositum and Tinctura Cinchonæ Composita.



FIG. 125.

An entire piece of saffron expanded in water, showing short style with three stigmas attached. Natural size.

## RED SANDERS WOOD

**Pterocarpi Lignum.**—‘The heart-wood of *Pterocarpus Santalinus*, *Linn. f.*’

*Characters.*—Imported in billets or logs of various sizes, but usually seen as raspings or coarse powder. It is of a deep blood-red colour, and has a slight astringent taste, but

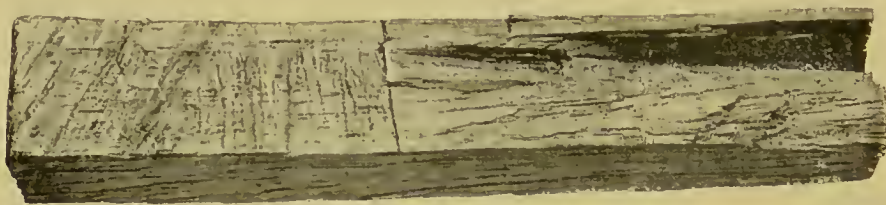


FIG. 126.

Red sanders wood.  $\frac{1}{2}$  linear.

no odour unless warmed, when it exhales a faint aroma. It tinges the saliva slightly when chewed. The logs are dark reddish-brown externally, and on section show alternating darker and lighter zones.

Compare with Logwood (page 422).

*Chief Constituents.*—Santalin, a red crystalline substance.

It is insoluble in water, forms a red solution with alcohol, and a violet with alkaline solutions.

Santal, pterocarpin, and homopterocarpin are colourless crystalline substances said to occur in red sanders wood.

*Pharmacology.*—It is slightly astringent, but is only employed as a colouring matter, and officially only to colour compound tincture of lavender.

**Tinctura Lavandulæ Composita.** See page 504.

## RED-POPPY PETALS

**Rhæados Petala.**—‘The fresh petals of *Papaver Rhæas*, *Linn.*,’ the common red poppy.

*Characters*.—Broadly elliptical, with an entire margin, smooth and shining, of a bright scarlet colour and provided with a short violet claw. They have a somewhat unpleasant heavy odour and a slightly bitter taste.

They change in colour to a brownish-violet on drying, and become useless for colouring purposes.

*Chief Constituents*.—Rhœadic and papaveric acids, both colouring principles.

A trace of morphine is said to occur, but is of no pharmacological importance. An alkaloid, rhœadine ( $C_{21}H_{21}NO_6$ ), which is very slightly basic and non-poisonous, is present. It forms colourless solutions in alcohol, which are changed to purple-red by acids. Strong mineral acids decompose it into a colouring matter and a more powerfully basic but isomeric alkaloid, rhœagenine.

### Syrupus Rhœados.

Red-poppy petals, 13 oz.; sugar,  $2\frac{1}{4}$  lb.; alcohol (90 per cent.),  $2\frac{1}{2}$  fl. oz.; distilled water, a sufficient quantity. The product should weigh 3 lb. 10 oz.

The alcohol is present as a preservative; the syrup tends to ferment without it.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.



## FERMENTS

PEPSIN and Liquor Pancreatis are official.

## PEPSIN

**Pepsinum.**—‘An enzyme obtained from the mucous lining of the fresh and healthy stomach of the pig, sheep, or calf.’ It should dissolve 2,500 times its weight of hard-boiled white of egg, when tested by the method given in the Pharmacopœia.

*Characters.*—Yellowish translucent grains or scales, or white or slightly yellowish powder, somewhat hygroscopic, with a faint odour (neither putrescent nor ammoniacal) and a saline taste. Soluble in about 100 parts of water, readily soluble in glycerin, insoluble in alcohol.

Pepsinum is not pure pepsin, but a mixture of the enzyme and albuminoid, saline, and other substances. Commercial pepsins vary considerably in activity, and some do not form a clear solution in water.

*Dose.*—5 to 10 grains.

*Pharmacology.*—The action of pepsin will be sufficiently familiar to the student. It is used to digest or aid digestion of the food in the stomach when, owing to atrophy of the gastric mucous membrane or a debilitated condition produced by some incurable disease (cancer, advanced tuberculosis, chronic Bright’s disease), the gastric juice is not secreted in sufficient quantity. It must not be regarded as a palliative for temporary derangement of digestion due to any cause, or as a routine remedy for chronic gastric catarrh. Such conditions are better treated by modifications in diet and in other ways.

Pepsin is sometimes used to predigest food, but much less frequently than preparations of the pancreas.

**Glycerinum Pepsini.**—A solution containing 5 grains of pepsin in 1 fluid drachm of an acidulated mixture of glycerin and distilled water.

Pepsin, 800 gr. ; hydrochloric acid, 110 minims ; glycerin, 12 fl. oz. ; distilled water, to make 20 fl. oz.

*Dose.*—1 to 2 fluid drachms.

*Pharmacology.*—It is a convenient form for administering pepsin by the mouth. The solution is stable.

#### PANCREATIC SOLUTION

**Liquor Pancreatis.**—Contains the digestive principles of 5 ounces of the fresh pancreas of the pig in 20 fluid ounces of 20 per cent. alcohol. It should digest 40 times its volume of milk, to which a little sodium bicarbonate has been added, in 1 hour at 45°C.

The solution is most active if prepared from a pig which has been fed a short time before being killed.

*Pharmacology.*—As trypsin is destroyed under ordinary conditions in the stomach if administered by the mouth, pancreatic solution and other preparations of the pancreas are almost solely used for predigesting food. Milk is commonly peptonised by adding to each pint about 20 grains of sodium bicarbonate dissolved in a little water, dividing the mixture into two equal halves, raising one portion to the boiling-point and adding it to the other ; finally adding two tablespoonfuls of Liquor Pancreatis and keeping the vessel warm for  $\frac{1}{2}$  to 1 hour, or sometimes more. Before peptonisation is complete, the milk acquires a bitter taste, which is objectionable to most people. It is therefore advisable to stop digestion by boiling the milk before this becomes distinctly evident.

Such peptonised foods are of great service whenever the stomach is unable to bear ordinary foods. They are

generally well borne and easily assimilated, and are best administered in small quantities at frequent intervals. If the stomach is unable to bear food of any kind or it is desirable to give it rest, peptonised foods may be given as enemata. They are absorbed from the rectum ; but since they can only be given in small quantity at comparatively long intervals (5 to 6 hours) nutrition can only be maintained for a few weeks in this way.

## UNCLASSIFIED ANIMAL PRODUCTS

WITH these will be included the Leech.

## THYROID PREPARATIONS

**Thyroideum Siccum.**—The dried and powdered healthy thyroid gland of the sheep, freed from fat and adhering connective tissue.

Any glands containing cysts are rejected. After mincing, drying, and powdering the glands, fat is removed by means of petroleum ether, and the product again dried.

*Characters.*—A pale buff-coloured powder, slightly hygroscopic, with a faint meat-like odour (devoid of any putrescence) and a meat-like taste. If it becomes damp it quickly deteriorates.

*Active Principle.*—Iodo-thyreoglobulin (a globulin containing combined iodine occurring in the colloidal matter). It may be decomposed into a proteid portion and a non-proteid part termed **iodothyryn** which is largely used in therapeutics and is commonly regarded as the active principle.

Recently the principle of the colloidal matter has been termed Thyreo-toxin. It is said to be formed by the union of an iodo-globulin secreted by the follicles and a toxic nucleo-proteid derived from the cell-nuclei of the food. In time a re-arrangement of the molecules of thyreo-toxin occurs, and it breaks up into two harmless substances—an iodo-globulin and a nucleo-proteid—which are excreted into the lymph and blood, and thus discharged from the body.

*Dose.*—3 to 10 grains.

**Liquor Thyroidei.**—‘A liquid prepared from the fresh and healthy gland of the sheep.’ Each gland is made into 100 minims of liquor.



One gland, freed from external fat and connective tissue; glycerin. 34 minims; 0.5 per cent. phenol in distilled water, to make 100 minims.

*Characters.*—A pinkish turbid liquid with a slight phenol odour, free from any putrescence. It does not keep, and consequently must be freshly prepared.

*Active Principle.*—The same as dry thyroid.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Thyroid preparations increase both proteid and carbo-hydrate metabolism and cause loss of weight. The urea, phosphates, and chlorides, and, probably as a consequence, the quantity, of urine are increased. In most people ordinary pharmacopœial doses produce no untoward effects, but in many a varied complex of symptoms known as **thyroidism** has occurred. Itching of the skin and palpitation have been common symptoms, but headache, giddiness, rise of temperature, rapid pulse, aching pains in the limbs, vomiting and diarrhœa, sweating, cutaneous eruptions, lassitude, sleeplessness, restlessness, and even more severe symptoms have been frequent. They appear to occur oftener in myxœdematous patients than in others, but large or repeated moderate doses will produce undesirable symptoms in most individuals. Thyroid gland is absorbed rather slowly.

It is of greatest service in diseases associated with atrophy of the thyroid gland (myxœdema, cretinism). In these brilliant results are obtained, but are only maintained so long as the thyroid administration is continued. Small doses (1 to 3 grains of dry thyroid) should be used at the commencement to avoid producing ill-effects. After a cure has been established, a small dose twice a week will usually maintain it.

Thyroid treatment has also been used for goitres, obesity, scaly skin diseases, especially psoriasis, and certain forms of insanity. In all, large doses of thyroid preparations have been given with irregular results. Obese persons frequently lose several pounds in weight during the first fortnight of the treatment, but this is not maintained, and unless a rigorous dietary is enforced, permanent benefit does not result.

## MUSK

**Moschus.**—‘The dried secretion from the preputial follicles of *Moschus moschiferus*, *Linn.*,’ the musk-deer.

*Characters.*—Reddish-brown to reddish-black, irregular grains or masses of grains, somewhat unctuous to the touch, with a characteristic persistent odour and a bitter taste.

It is very liable to be adulterated, to such an extent that it is said that pure musk is difficult to obtain. It should not yield more than 8 per cent. of ash.

The musk is usually exported in the musk-sac. This on the outer side is greyish or brownish-yellow, and shows stiff hairs, appressed and concentrically arranged around a nearly central orifice. The inner surface is covered with a thin membrane.

*Constituents.*—The odoriferous ingredient has not been isolated.

Besides this it contains a bitter resinous substance, cholesterolin, fatty and albuminous matters, &c., and, in the fresh state ammonia.

*Dose.*—5 to 10 grains.

*Pharmacology.*—It is merely an odorous substance. As far as is known, it possesses no specific effects; indeed, it has probably no definite action. It has been used as a cardiac and nervous stimulant, and as an antispasmodic, but it is of doubtful value. Its main use is in perfumery.

Artificial musk is tri-nitro-butyl-toluene.



FIG. 127.

Musk sac. Outer surface, showing concentric arrangement of hairs around nearly central orifice. Natural size.

## PURIFIED OX BILE

**Fel Bovinum Purificatum.**—An alcoholic extract of the bile of the ox, of thick consistence.

The fresh ox bile is evaporated to a quarter of its bulk, extracted with double the volume of 90 per cent. alcohol, and the clear alcoholic solution evaporated on a water-bath to a thick consistence.

*Characters.*—A dark yellowish-green substance, somewhat hygroscopic, with an unpleasant, bitter, but partly sweet taste. Soluble in water and in alcohol.

It should give Pettenkofer's reaction, and should give no precipitate when its aqueous solution is added to 90 per cent. alcohol, showing absence of unpurified ox bile.

*Dose.*—5 to 15 grains.

*Pharmacology.*—Its action is similar to that of the normal bile. This plays an important part in the action of some purgatives. It has been employed in cases where the excretion of bile into the duodenum is deficient or wanting (as in obstructive jaundice), especially in combination with those purgatives which require the presence of bile for their full action, but it is rarely employed at the present time. Unless administered in keratin-coated capsules or pills it is liable to derange the stomach.

## CLARIFIED HONEY

**Mel Depuratum.**—‘Honey of commerce, melted in a water-bath, and strained, while hot, through flannel previously moistened with warm water.’

*Characters.*—A yellowish to brown syrupy liquid, with a characteristic, slightly variable odour, and a very sweet taste.

When kept, it becomes a granular pasty mass owing to crystallisation of the sugar.

It should contain no starch and only traces of sulphates, and should yield not more than 0.25 per cent. of ash.

*Chief Constituent*.—Invert sugar (dextrose and levulose) (about 75 per cent.).

It contains also small quantities of proteids, wax, volatile oil, formic acid, and other substances.

*Pharmacology*.—Its action is similar to that of cane sugar. Small quantities are demulcent to the mouth and throat; large quantities are laxative but sometimes produce griping.

It is an ingredient of *Confectio Piperis*, *Mel Boracis*, *Oxymel*, and *Oxymel Scillæ*.

## LEECHES

Two kinds of leeches are official—the green leech and the speckled leech. They differ in the appearance of their ventral surface.

**Hirudo**. — ‘1. *Sanguisuga medicinalis*, *Savigny*, the Speckled Leech; and 2. *Sanguisuga officinalis*, *Savigny*, the Green Leech.’

*Characters*.—An elongated flattened aquatic worm, about 4 inches in length. Body soft, smooth, marked with 90 to 100 annulations, widest a little behind the middle and gradually tapering towards each end, where it terminates in a sucker, the anterior sucker being small, oval, somewhat ventral, and perforated by the mouth with its tri-radiate jaws, the posterior being large, round, and imperforate. The dorsum is convex, dark olive-green, and marked with three pairs of rusty-red stripes. The ventral surface is much less convex and lighter in colour, being greenish-yellow spotted with black in the speckled leech, and olive-green, not spotted, in the green leech.

*Pharmacology*.—They are used to extract blood locally. They attach themselves by the anterior sucker and cut through the skin by means of their tri-radiate jaws (hence they leave a characteristic tri-radiate mark) and suck blood until they are gorged, when they drop off. The blood is prevented from coagulating by the salivary secretion. As some



of this is left in the wound it is sometimes necessary to apply an astringent to stop the bleeding. One leech abstracts from one to two teaspoonfuls of blood.

They are used to relieve localised visceral pain and inflammation. Thus they are applied over the cardiac region in pericarditis, over the back in pleurisy, and over the liver in hepatic congestion. Five to ten are commonly used, and generally with benefit.

# APPENDIX

## INDIAN AND COLONIAL ADDENDUM

THIS Supplement to the Pharmacopœia was published in 1900 for the purpose of making official and thereby giving a certain standard to remedies employed by medical practitioners in India, the colonies, and other dependencies. Many of these remedies are similar in action to, and a few are practically identical in composition with, some in the body of the Pharmacopœia. Thus the action of *Urginea* is so similar to that of *Scilla*, and *Mylabris*, the Chinese blistering beetle, to that of *Cantharis*, that the numerous preparations of *Urginea* and *Mylabris* are the same in kind and mode of preparation as those of *Scilla* and *Cantharis* respectively. The drugs of the Addendum, however, are not intended to be used by pharmacists and dispensers as substitutes for other official drugs. They are only for the use of medical practitioners acquainted with their action and uses, and are official mainly because they can be obtained more easily than other drugs allied to them in action.

The various colonies and dependencies are divided by the pharmacopœial authorities into Indian, African, Australasian, Eastern, Mediterranean, North American, and West Indian. The Eastern colonies include Ceylon, Hong Kong, Labuan, Mauritius, Seychelles Islands, and Straits Settlements. The components of the other groups will be readily understood.

By far the largest number of drugs is for the use of practitioners in India and the Eastern colonies, and as, with one exception,<sup>1</sup> they are identical, they will be described together and taken first.

<sup>1</sup> *Agropyrum* is official for the Eastern colonies, but not for India.

## MODIFICATIONS OF OFFICIAL PREPARATIONS

Modifications in certain official preparations are allowed in India and those colonies and dependencies where the prevailing high temperatures make these preparations too soft for use or liable to undergo fermentation ; or, in a few cases, where the drug in the form specified by the Pharmacopœia cannot be obtained. These modifications are as follows.

**Adeps Induratus.**—Lard deprived of a portion of its oil by pressure. It may be used in place of lard in making the preparations into which this enters.

**Aquæ.**—The modification referred to (page 20), viz. triturating the essential oil with twice its weight of calcium phosphate, and afterwards with 500 times its weight of distilled water, and filtering, is allowed for certain waters. Waters thus prepared are distinguished by the addition of *Oleum* to the name. Those allowed are—

Aqua Olei Anethi, Aqua Olei Anisi, Aqua Olei Carui, Aqua Olei Cinnamomi, Aqua Olei Fœniculi, Aqua Olei Menthæ Piperitæ, Aqua Olei Menthæ Viridis, Aqua Olei Pimentæ.

**Emplastra.**—The addition of more or less hard soap, indurated lard, resin, or yellow beeswax is allowed, provided that the proper proportion of active ingredient in the finished product is maintained.

**Extracta Liquida.**—Any liquid extract containing less than  $\frac{1}{4}$  its weight of 90 per cent. alcohol may have the proportion increased to this amount where necessary.

**Limonis Cortex Siccatus.**—Dried lemon peel may be substituted for the fresh peel in making compound infusion of orange peel, compound infusion of gentian, syrup of lemon, and tincture of lemon, in places where the fresh peel cannot be obtained.

**Suppositoria.**—More or less white beeswax may be used in place of an equivalent quantity of oil of theobroma where necessary.

**Syrupus Rhœados.**—The quantity of alcohol may be increased to not more than double the quantity previously specified (page 571); an equivalent amount of water must be omitted.

**Unguenta.**—More or less indurated lard, prepared suet, yellow beeswax, or white beeswax may be used, provided that the official proportion of active ingredient is maintained.

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## INDIA AND EASTERN COLONIES

## ACACIA BARK

**Acaciæ Cortex.**—The dried bark of *Acacia arabica*, *Willd.*, or of *Acacia decurrens*, *Willd.*, obtained from wild or cultivated trees at least seven years old, and, after drying, kept one year before use.

*Characters.*—1. *Acacia arabica* (Babûl bark). Hard and woody, and tending to divide into layers. Externally rusty brown, older pieces being covered with a thick, blackish, fissured periderm. Internally smooth but fibrous, and longitudinally striated. Taste astringent and mucilaginous.

2. *Acacia decurrens* (see page 610).

*Chief Constituents.*—Tannin (about 20 per cent.); gum.

A small quantity of gallic acid is also present.

**Decoctum Acaciæ Corticis.**—1 in 16.<sup>1</sup>

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

*Pharmacology.*—It is markedly astringent, owing to the tannin it contains. Its action is similar to that of other tannin-containing drugs (see page 412), and it may be used for the same purposes. It is employed chiefly as an astringent injection in inflammatory conditions of mucous membranes (leucorrhœa, diarrhœa, &c.), and is given by the mouth for diarrhœa.

## ACALYPHA

**Acalypha.**—‘The fresh and dried herb, *Acalypha indica*, *Linn.*’

*Characters.*—An annual; stem erect, 1 to 2 feet high; leaves ovate to rhomboid-ovate, with three principal nerves, the two external branching on the outer side only, serrated, except on the

<sup>1</sup> See foot-note page 20.



lower tapering portion; petiole long; flower spikes axillary and bearing numerous small green flowers, crowned by a cross-shaped body, the base of which is surrounded by a three-leaved calyx.

*Active Principle*.—Probably acalyphine, an alkaloid.

Tannin and a volatile oil are also present. The alkaloid has not been isolated in a pure condition, and nothing is known regarding its pharmacology.

Prepared from the **fresh** herb.

**Succus Acalyphæ**.—The juice to which  $\frac{1}{3}$  its volume of 90 per cent. alcohol has been added.

*Dose*.—1 to 4 fluid drachms.

Prepared from the **dried** herb.

**Extractum Acalyphæ Liquidum**.—1 in 1.

*Dose*.—5 to 30 minims.

*Pharmacology*.—Its action is somewhat similar to that of ipecacuanha root (see page 340), but it is also stated to be laxative. Full doses of the succus produce vomiting, and are used to dislodge excessive bronchial secretion in cases of bronchitis in children, and for other purposes for which emetics are useful. Small doses of both preparations are chiefly expectorant, and are used in the treatment of bronchitis. The juice made into a liniment is sometimes used as a mild counter-irritant in rheumatic and other pains, and it has been applied in chronic skin diseases.

#### ADHATODA

**Adhatoda**.—‘The fresh and dried leaves of Adhatoda Vasica, *Nees*.’

*Characters*.—Smooth, lanceolate, entire, 5 to 6 inches long, and about  $1\frac{1}{2}$  inches broad. The dried leaves are dark green, but yield a powder of a lighter tint. The odour is strong, characteristic, and somewhat tea-like; the taste is bitter.

*Chief Constituents*.—Vasicine, a crystalline alkaloid; a volatile oil.

The alkaloid occurs combined with adhatodic acid.

Prepared from the **fresh** leaves.

**Succus Adhatodæ**.—The strained juice.

*Dose*.—1 to 4 fluid drachms.

Prepared from the **dried** leaves.

**Extractum Adhatodæ Liquidum.**—1 in 1.

*Dose.*—20 to 60 minims.

**Tinctura Adhatodæ.**—1 in 8.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It is said to be poisonous to lower animals (insects, fish, frogs), but not to mammals. It is used as an expectorant in phthisis and chronic bronchitis, and as an antispasmodic, chiefly in the form of cigarettes made of the dried leaves, in asthma. A considerable quantity of ammonia appears to be formed when the leaves are smoked.

#### COUCH GRASS—TRITICUM

**Agropyrum.**<sup>1</sup>—‘The dried rhizome of *Agropyrum repens*, *Beauvois* (*Triticum repens*, *Linn.*).’

*Characters.*—The long, slender rhizome, which is about  $\frac{1}{10}$  inch thick, is usually cut into pieces from  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in length. These, when dried, are pale yellow, rigid, marked with 5 or 6 longitudinal ridges, and hollow except at the nodes, which may show the remains of roots and leaf-bases. It has no odour, but has a faintly sweet and bland taste.

*Chief Constituents.*—Triticin (7 to 8 per cent.), a carbohydrate yielding levulose on hydrolysis; sugar; mucilage; organic salts (malates, &c.). It contains no starch.

**Decoctum Agropyri.**—1 in 20.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

**Extractum Agropyri Liquidum.**—1 in 1.

*Dose.*—1 to 2 fluid drachms.

*Pharmacology.*—It is demulcent, and is said to be diuretic. It is used chiefly as an auxiliary agent in the treatment of diseases of the genito-urinary tract.

#### ALSTONIA

**Alstonia**—dita bark. ‘The dried bark of *Alstonia scholaris*, *R. Brown*, and of *Alstonia constricta*, *P. v. M.*’

The former bark is official for India and the Eastern colonies; the latter for the Australasian colonies.

<sup>1</sup> *Agropyrum* is not official in India.

*Characters*.—1. *Alstonia scholaris*. Somewhat spongy, irregular fragments, from  $\frac{1}{8}$  to  $\frac{1}{2}$  inch thick. Externally rough, fissured, brownish-grey, occasionally marked by blackish spots; internally of a bright buff colour. Fracture short and coarse, the fractured surface under a lens showing numerous fine medullary rays. No distinctive odour; taste bitter when chewed.

2. *Alstonia constricta* (see page 610).

*Chief Constituents*.—**Ditamine** (0·04 per cent.), a crystalline alkaloid; echitamine, a crystalline alkaloid; echitenine, an amorphous alkaloid.

Ditaine is an impure mixture of these. The bark also contains three crystalline substances—echieerin, echitin, echitein—and two amorphous substances—echiretin and echieaoutchin—and other unimportant ingredients.

**Infusum Alstoniæ**.—1 in 20.

*Dose*.— $\frac{1}{2}$  to 1 fluid ounce.

**Tinctura Alstoniæ**.—1 in 8.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—Ditaine, the mixture of alkaloids, injected into frogs in doses of  $\frac{1}{2}$  grain, depresses the spinal cord, and, later, paralyzes the muscles and the vagus nerve-endings;  $1\frac{1}{2}$  grain injected into mammals produces a curare-like action.

The drug is used as a bitter tonic in small doses, and as a remedy for malaria and malarial conditions in large doses. It has been said to be as valuable as cinchona bark for malaria, and to be practically free from ill-effects. It is also used as an anthelmintic, and as a remedy for chronic diarrhœa and the later stages of dysentery. In certain cases the tincture is said to have acted as a galactagogue.

#### ANDROGRAPHIS

**Andrographis**—Creat, Kiryát. ‘The dried plant, *Andrographis paniculata*, *Nees*.’

*Characters*.—Stem dark-green, somewhat quadrangular, longitudinally furrowed, and slightly winged in the upper portion, 1 to 3 feet in length. Root simple, fusiform, woody. Leaves thin and brittle, lanceolate, entire; upper surface dark-green, smooth, and shining; lower surface paler and finely granular; up to 3 inches in length and 1 inch broad; opposite and shortly petiolate. Calyx hairy and deeply 5-cleft. Fruits are erect, 2-valved cap-

sules, somewhat cylindrical in shape with tapering ends, and marked by a longitudinal furrow on each valve. The drug has a very bitter taste, but no odour.

*Active Principle*.—A bitter neutral principle.

**Infusum Andrographidis**.—1 in 20.

*Dose*.— $\frac{1}{2}$  to 1 fluid ounce.

**Liquor Andrographidis Concentratus**.—1 in 2.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Andrographidis**.—1 in 10.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—It has the action of a bitter, and is employed in the conditions for which bitters are useful (page 453). It is sometimes called Indian Chiretta. Its preparations darken on the addition of salts of iron.

#### ARISTOLOCHIA

**Aristolochia**—the Indian birthwort. ‘The dried stem and root of *Aristolochia indica*, *Linn.*’

*Characters*.—1. Stem. Usually seen in more or less cylindrical pieces, about  $\frac{5}{8}$  inch in diameter, marked with projecting scars of leaves and branches. Bark greyish-yellow; in young specimens marked with longitudinal furrows and reticulations; in old specimens warty, with few transverse fissures and longitudinal furrows. The transverse section shows a somewhat thick bark and a central woody portion in which distinct wedge-shaped pieces of xylem can be seen.

2. Root. Dark orange-brown, undulated, and showing distinct transverse constrictions. The bark is easily separated from the wood and is often absent in patches.

The odour of both stem and root is aromatic and camphoraceous; the taste is bitter and somewhat camphoraceous.

*Chief Constituents*.—An alkaloid (aristolochine?); yellow acid resinous matter; volatile oil; tannin.

**Liquor Aristolochiæ Concentratus**.—1 in 2.

*Dose*.— $\frac{1}{2}$  to 2 fluid drachms.

**Tinctura Aristolochiæ**.—1 in 5.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.



*Pharmacology*.—Its action is chiefly that of an aromatic bitter, and it may be used in the conditions in which such drugs are of benefit (see page 454). It has been given in intermittent and other fevers, in labour to increase the contractions of the uterus, and as a remedy, internally and externally, in snake bites, but it is probably of little value in such conditions.

#### INDIAN ORANGE PEEL

**Aurantii Cortex Indicus**.—‘The fresh and dried outer part of the pericarp of varieties of *Citrus Aurantium*, grown in India and Ceylon.’

*Characters*.—Similar to those described (page 462).

It may be used for making the preparations into which fresh and dried bitter-orange peel enter (pages 462, 463).

#### INDIAN AZADIRACH

**Azadirachta Indica**—Neem (Nim) or Margosa bark. ‘The dried bark of the stem of *Melia Azadirachta*, *Linn.*,’ the Indian lilac.

*Characters*.—Slightly channelled pieces, varying in size, but usually 2 or 3 inches wide, and about  $\frac{1}{8}$  inch thick. Externally rusty-grey, rough, and cracked; internally yellowish and foliated. Fracture fibrous. It has no odour, but has a bitter, slightly astringent taste.

*Chief Constituents*.—A bitter amorphous resinous substance; an alkaloid? tannin; gum.

An alkaloid has been obtained from the seeds, and it probably exists in the bark, but it has not been isolated.

**Infusum Azadirachtæ Indicæ**.—1 in 100.

It is prepared with cold distilled water.

*Dose*.— $\frac{1}{2}$  to 1 fluid ounce.

**Tinctura Azadirachtæ Indicæ**.—1 in 10.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—Its action is that of a bitter, and it is used mainly as such (page 453). It is said to be useful in malaria. Owing to the tannin it contains, it is slightly astringent and is also incompatible with preparations of iron.

(Other parts of the Indian lilae are used, more especially by natives, for various purposes; the leaves, as a poultice or decoction for skin diseases; the root-bark, as an anthelmintic; the sulphur-containing oil from the seeds, for skin diseases and as a stimulating embrocation in chronic rheumatism, &c.)

#### BAEL FRUIT

**Belæ Fructus.**—‘The fresh half-ripe fruit of *Ægle Marmelos*, *Correa*,’ the Bengal quincee.

*Characters.*—Globular to pear-shaped, about the size of a large orange, hard, nearly smooth, pale yellowish-brown to greyish-brown, and showing a circular scar where the peduncle was attached. The rind is about  $\frac{1}{8}$  inch thick, and consists of an outer portion containing oil-glands and an inner, more woody portion. It encloses 10 to 15 carpels or cells which are firmly adherent to it, each of which contains several compressed seeds covered with whitish woolly hairs embedded in a yellowish or reddish mucilaginous pulp. The odour is slightly aromatic; the taste mucilaginous and slightly acid and astringent.

Dried transverse slices of the fruit are also used, but are not official. The rind is reddish; the pulp is hard, brittle, orange-brown to cherry-red externally, paler within.

*Chief Constituents.*—Tannin (small quantities); organic acids; mucilaginous and pectinous substances.

**Extractum Belæ Liquidum.**—1 in 1.

*Dose.*—1 to 2 fluid drachms.

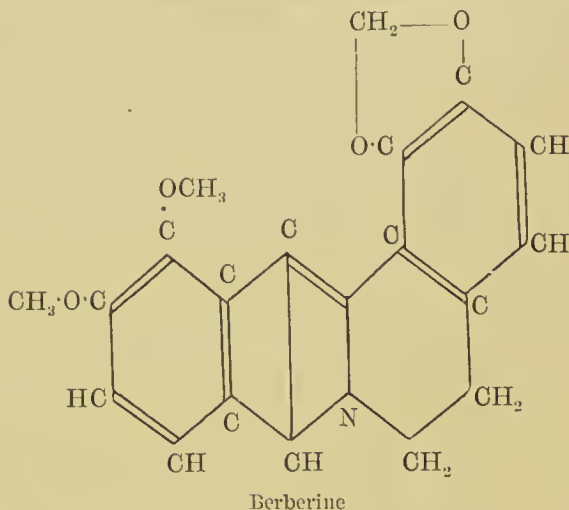
*Pharmacology.*—It is mildly astringent, and is used principally in chronic diarrhoea and the later stages of dysentery.

#### BERBERIS

**Berberis.**—‘The dried stem of *Berberis aristata*, *DC.*,’ the Indian barberry.

*Characters.*—Undulating pieces, 1 to 2 inches thick; orange-brown and marked with slightly wavy longitudinal striæ and occasionally with shallow longitudinal depressions, except in patches where the periderm has been removed, which exhibit the darker brown cortex. The transverse section shows a brown bark and a bright-yellow, finely radiate wood. The odour is slight; the taste bitter.

*Chief Constituents.*—Berberine, a yellow crystalline alkaloid; oxyacanthine, a colourless crystalline alkaloid; tannin.



Oxyacanthine  $C_{17}H_{11}(OH)(OCH_3)_2N$ .

Berberine ( $C_{18}H_{19}NO \cdot 2H_2O$ ) is said to occur in the root, but has not been found in the stem.

**Liquor Berberidis Concentratus.**—1 in 2.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Berberidis.**—1 in 10.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is chiefly that of a bitter (page 453); it is also slightly laxative. It is used as a bitter and also as a remedy for chronic diarrhoea and dysentery, and for malaria. For the last-named disease it is very inferior to quinine.

Berberine injected into animals depresses the motor centres and the spinal cord;  $1\frac{1}{2}$  grains administered thus to a rabbit caused paralysis, diarrhoea, fall of temperature, and death from respiratory and cardiac failure. When administered by the mouth, however, 12 grains produced only relaxation of the bowels, and slight tremors and depression.

In men, doses of 8 to 15 grains given by the mouth have only a laxative action; even 50 grains produced no other distinct symptoms.

In view of its use in malaria it is interesting to note that it diminishes or inhibits the amœboid movements of white blood-corpuscles.

## BETEL

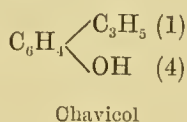
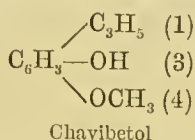
**Betel.**—‘The leaves of Piper Betle, *Linn.*,’ the betel pepper.

*Characters.*—Yellowish and brittle, broadly ovate, acuminate, obliquely cordate at base, 5- or 7-nerved, having a warm aromatic and somewhat bitter taste.

They frequently occur in commerce tied up or stitched together into packets.

*Active Principle*.—A volatile oil.

It consists mainly of chavibetol, but also contains chavicol, cadinene, and other terpenes and oxygenated substances. The oil obtained from betel grown in different countries varies somewhat in composition.



*Pharmacology*.—Its action is similar to that of drugs containing a volatile oil (page 469), and it may be used for the same purposes.

Chavibetol is an isomer of eugenol (page 484) and has a very similar action to this substance. It is said, however, to be more powerfully antiseptic.

Betel leaves are used largely as a domestic remedy for a number of conditions, and, mixed with lime and black catechu, or with cardamoms and other aromatics, are habitually chewed as a gentle exhilarant.

#### BUTEA GUM

**Buteæ Gummi.** Bengal Kino. ‘The inspissated juice obtained from incisions in the stem of *Butea frondosa*, *Roxb.*,’ the Dhák tree.

*Characters*.—Small, irregular, shining fragments of a dark ruby colour, without odour, but with a strongly astringent taste. Thin laminae are transparent. Partially soluble in water and in alcohol, the alcoholic solution being nearly colourless.

About 40 per cent. should be soluble in hot 90 per cent. alcohol. By keeping, the gum becomes duller and darker and less soluble in alcohol.

The gum is frequently contaminated with pieces of corky bark and other impurities. These should be removed before it is used.

*Constituents*.—Tannin (20 to 60 per cent.) ; gum (about 20 per cent.) ; colouring and extractive matter.

*Pharmacology*.—Its action and uses are similar to those of kino and other tannin-yielding drugs (see page 412). It may be employed in place of kino to make the preparations into which this substance enters (page 418).

#### BUTEA SEEDS

**Buteæ Semina.**—‘The seeds of *Butea frondosa*, *Roxb.*’

*Characters*.—Flat reniform seeds, 1 to 1½ inches long, ¾ to 1 inch broad, ¼ to ½ inch thick, having a thin, glossy, dark



reddish-brown, veined and wrinkled seed-coat, which encloses two large yellow leafy cotyledons, and shows a prominent hilum near the middle of the concave edge. The odour is faint; the taste slightly acrid.

*Active Principles.*—Unknown.

**Pulvis Buteæ Seminum.**—The seeds deprived of the seed-coat by soaking in water, dried and powdered.

*Dose.*—10 to 20 grains.

*Pharmacology.*—The seeds are used as a remedy to expel the round worm. They have also a laxative effect. Occasionally vomiting, and even irritation of the kidneys, is said to follow their use.

Made into a paste with lemon juice, they produce a rubefacient effect when applied to the skin, and are employed in chronic ringworm and allied conditions.

## CALOTROPIS

**Calotropis**—mudar. ‘The dried root-bark of *Calotropis procera*, *R. Brown*; and of *Calotropis gigantea*, *R. Brown*; freed from the outer corky layer.’ Both varieties occur mixed in the commercial drug.

*Characters.*—Short, more or less quilled pieces,  $\frac{1}{10}$  to  $\frac{1}{8}$  inch thick, but not exceeding  $1\frac{1}{2}$  inches in width, covered with a soft greyish-buff outer layer, strongly furrowed and reticulated, and easily separated from the underlying yellowish-white tissues. Internal surface pale brown, somewhat granular. Fracture mealy. Odour faint; taste mucilaginous, bitter and acrid.

The soft outer bark must be removed before the drug is used.

*Active Principle.*—A crystalline bitter principle?

A yellow bitter resin has also been obtained.

The juice of the plant yields a kind of caoutchouc, which contains substances similar to those obtained from gutta-percha.

*Dose, in powder.*—3 to 10 grains as a tonic; 30 to 60 grains as an emetic.

**Tinctura Calotropis.**—1 in 10.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action resembles somewhat that of ipecacuanha root (page 340). The juice applied externally is irritant. The bark taken by the mouth in small doses acts as a mild diaphoretic and expectorant. In large doses it produces

vomiting accompanied by much nausea, and may also cause diarrhœa.

It has been used in a large number of diseases—bronchitis, dysentery, malaria, syphilis, leprosy, chronic rheumatism, elephantiasis, &c.—but it is probably of greater service when applied externally than when given internally.

#### INDIAN GAMBOGE

**Cambogia Indica.**—‘The gum-resin obtained from *Garcinia Morella*, *Desrouss.*’

*Characters.*—It occurs in irregular fragments, but is otherwise similar to Siam gamboge (page 528). It must be free from particles of wood, and other extraneous matter.

*Constituents.*—Practically the same as Siam gamboge (page 529).

*Dose.*— $\frac{1}{2}$  to 2 grains.

*Pharmacology* (see page 529).

#### BLACK CATECHU.

**Catechu Nigrum**—cutch. ‘An extract prepared from the wood of *Acacia Catechu*, *Willd.*’

*Characters.*—Usually in irregular, hard, brittle, dark-brown or nearly black masses, with a sweetish astringent taste, but without odour. It breaks with a somewhat conchoidal fracture; the fractured surface is porous and glossy, occasionally softish internally. It yields a dull reddish-brown powder. Partially soluble in cold, almost entirely in boiling water, but depositing crystals (catechin) on cooling; at least 80 per cent. should be soluble in 90 per cent. alcohol.

It should yield not more than 6 per cent. of ash.

*Chief Constituents.*—Catechu-tannic acid (30 to 40 per cent.); catechin (aca-catechin).

Catechu-red, quercetin, and other unimportant substances occur.

Catechu-tannic acid gives a dark-green colour with solutions of ferrie salts. The same reaction is obtained with an aqueous solution of catechu. If made alkaline with caustic soda solution, the colour changes to purple. The relation of catechu-tannic acid to catechin and catechu-red is given on page 417.

*Dose.*—5 to 15 grains.

*Pharmacology.*—Its action is similar to that of pale catechu.

It may be used for making the preparations into which pale catechu enters (page 417).

## CISSAMPELOS

**Cissampelos**—false pareira root. ‘The dried root of Cissampelos Pareira, *Linn.*’

*Characters.*—Dark-brown, slightly compressed, undulating pieces, about  $\frac{1}{2}$  inch in diameter, marked by broad, shallow longitudinal furrows and fine transverse cracks. The fracture is fibrous. A transverse section shows a narrow bark and a yellowish-brown wood which is composed of 10 to 20 radial wedges separated by narrow medullary rays. The bark is easily separated from the wood. It has no odour, but has a bitter taste.

*Active Principle.*—Pelosine (about 0.5 per cent.), an alkaloid (see page 353).

**Decoctum Cissampeli.**—1 in 8.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

**Extractum Cissampeli Liquidum.**—Contains approximately  $\frac{1}{4}$  its weight of the water-soluble ingredients of the root.

*Dose.*— $\frac{1}{2}$  to 2 fluid drachms.

*Pharmacology.*—Its action and uses are similar to those of pareira root (page 353).

## COSCINIUM

**Coscinium**—false calumba. ‘The dried stem of Coscinium fenestratum, *Colebr.*’

*Characters.*—Cylindrical, straight or twisted pieces, up to 4 inches in diameter, with a pale yellowish-grey cork, which is generally absent in patches, displaying the brown cortex; furrowed longitudinally, and sometimes showing narrow transverse fissures. The fracture is splintery. The transverse section shows a more or less thick bark enclosing a single ring of wedge-shaped wood bundles, separated by lighter-coloured expanding medullary rays, which further encloses a small central pith. It has no odour, but has a bitter taste.

*Chief Constituents.*—Berberine, a yellow crystalline alkaloid (see page 590); a saponin.

A yellow dye-stuff is also present.

**Infusum Coscinii.**—1 in 20.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Liquor Coccinii Concentratus.**—1 in 2.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Coccinii.**—1 in 10.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is mainly that of a bitter, and it is used almost solely as such (see page 453). For the action of berberine see page 590.

#### DATURA LEAVES

**Daturæ Folia.**—‘The dried leaves of *Datura fastuosa*, *Linn.* var., *alba*, *Nees*, and of *Datura Metel*, *Linn.*’

*Characters.*—Somewhat similar in appearance to stramonium leaves (page 268). Ovate, acuminate, with a sinuate-dentate margin, and usually unequal at the base; up to 8 inches in length and 5 inches in breadth. The petiole is long. The odour is characteristic, the taste bitter.

*Active Principles.*—Hyoscyne, hyoscyamine, and atropine. (Daturine is a mixture; see page 269.)

*Pharmacology.*—Their action is that of the alkaloids they contain (see page 257). They produce symptoms similar to those produced by belladonna leaves, but in most cases there is less delirium and a more evident comatose condition owing to the greater quantity of hyoscyne they contain. The leaves smoked in the form of cigarettes are sometimes useful in asthma.

#### DATURA SEEDS

**Daturæ Semina.**—‘The dried seeds of *Datura fastuosa*, *Linn.*, var. *alba*, *Nees*.’

*Characters.*—Dull yellowish-brown, finely pitted and reticulated, laterally compressed, somewhat wedge-shaped, with rounded, thickened, furrowed wavy margins; about  $\frac{1}{8}$  inch broad and  $\frac{1}{25}$  inch thick; without odour, but having a bitter taste.

*Active Principles.*—The same as the leaves.

**Tinctura Daturæ Seminum.**—1 in 4.

*Dose.*—5 to 15 minims.

*Pharmacology.*—The seeds have the same action as the leaves. They are used largely by professional poisoners and thieves in India. The tincture may be employed for any of the purposes for which tincture of belladonna is useful.



## EMBELIA

**Embelia.**—‘The fruit of *Embelia Ribes*, *Burm.*, and of *Embelia Robusta*, *Roxb.*’

*Characters.*—Globular fruits, warty or striated longitudinally, and crowned by a small beak; of a dull red, marked with dark spots, or nearly black colour; about  $\frac{1}{8}$  inch in diameter. The 5-partite calyx attached to a slender pedicel is often present. They contain a reddish horny seed, marked with lighter-coloured spots, depressed at the base, and surrounded by a delicate membrane. The fruits have a slightly astringent and aromatic taste.

*Active Principle.*—Embelic acid.

Small amounts of tannin, volatile oil, resinous matter &c., are present.

*Dose in powder.*—1 to 4 drachms.

*Pharmacology.*—It is used like cusso as an anthelmintic for tapeworms. It is necessary to administer a purgative afterwards.

## COTTON ROOT BARK

**Gossypii Radicis Cortex.**—‘The dried root-bark of *Gossypium herbaceum*, *Linn.*’

*Characters.*—Thin flexible bands or quilled pieces, covered with a thin brownish-yellow outer bark, marked with fine longitudinal ridges and meshes, and with small black dots or transverse lines. Where the outer bark is abraded the orange-brown cortex is displayed. The inner surface is whitish, silky, and finely striated. The fracture is tough and fibrous. The bark is separable into papery layers. It has no odour, but has a somewhat acrid astringent taste.

Compare with mezereon bark (page 434).

*Active Principle.*—A yellow resin (about 8 per cent.).

A yellow chromogen which becomes red and resinous with age, tannin, and unimportant substances are present.

**Decoctum Gossypii Radicis Corticis.**—1 in 5.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

**Extractum Gossypii Radicis Corticis Liquidum.**—1 in 1.

The menstruum contains glycerin (1 in 4).

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—It has been employed chiefly in uterine affections—dysmenorrhœa, hæmorrhage from tumours, &c. It has also been recommended in hæmorrhage from the lungs and other parts, and as a substitute for ergot after labour. Experimental investigations have failed to substantiate its value in such conditions.

#### INDIAN GUM

**Gummi Indicum**—ghatti gum. ‘A gummy exudation from the wood of *Anogeissus latifolia*, *Wall.*’

*Characters.*—Dull whitish or amber-coloured, translucent, vermiform or rounded tears, varying in size, having a bright glassy fracture, a faint odour, and a bland mucilaginous taste. Soluble in water; insoluble in alcohol.

Its aqueous solution is about twice as viscid as that of gum acacia; it is gelatinised by a solution of borax. It should not yield more than 4 per cent. of ash, or contain any inferior gums, or starch or dextrin. It should give no coloration with solution of ferric chloride or precipitate with solution of lead acetate.

Its aqueous solution may be distinguished from that of gum acacia by giving a smaller precipitate with solution of lead subacetate and a greater precipitate with solution of mercuric chloride.

*Constituents.*—Similar to gum acacia (see page 556).

It may be used in place of gum acacia to make the preparations into which this enters, but, owing to the greater viscosity it gives, only half the quantity of the gum acacia ordered must be used.

**Mucilago Gummi Indici.**—One part of gum is dissolved in 3 fluid parts of distilled water.

It may be employed instead of *Mucilago Acaciæ* in making preparations.

*Pharmacology.*—Its action and uses are the same as those of gum acacia.

#### HYGROPHILA

**Hygrophila.**—‘The dried herb including the root of *Hygrophila spinosa*, *T. Andl.*’

*Characters.*—Root tapering, with numerous rootlets. Stem 2 to 4 feet long, quadrangular, marked with swollen nodes, sparingly branched, the branches and leaves being opposite. At each node six leaves arise, the two outer being large, the four inner smaller. Four pairs of bright purplish-blue (rarely white) flowers

arise from each node. Scattered whitish hairs occur on the stem and leaves, especially near the nodes and on the young leaves. The brownish flattened seeds (four to eight in each fruit) exude a tenacious fluid when moistened, and therefore adhere to the tongue when placed in the mouth.

*Active Principles.*—Unknown.

A colourless crystalline substance insoluble in water or alkalies has been isolated. An extract of the drug is also said to give general alkaloidal reactions.

**Decoctum Hygrophilæ.**—1 in 10.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

*Pharmacology.*—It is a bitter, and is said to be diuretic. It is employed chiefly in dropsical conditions and diseases of the genito-urinary tract.

#### ISPAGHULA

**Ispaghula**—spogel seeds. ‘The dried seeds of *Plantago ovata*, *Forsk.*’

*Characters.*—Boat-shaped, somewhat acute at one end, pinkish-grey in colour with a darker elongated spot on the convex side,  $\frac{1}{10}$  to  $\frac{1}{8}$  inch in length,  $\frac{1}{15}$  to  $\frac{1}{16}$  inch wide. When placed in water the seed-coat swells and becomes covered with a viscid mucilage.

*Active Principles.*—None of importance. The seed-coat contains mucilage; the kernel contains proteid and fatty matters.

*Dose in powder.*—50 to 150 grains.

**Decoctum Ispaghulæ.**—1 in 73.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

*Pharmacology.*—Its action is similar to that of linseed (page 547). The crushed seeds are used in the form of poultices. The decoction is used in catarrhal conditions of the throat. The seeds, whole (!) or crushed, mixed with water, are given in chronic diarrhoea and the later stages of dysentery.

#### KALADANA

**Kaladana**—Pharbitis Nil. ‘The dried seeds of *Ipomœa hederacea*, *Jacq.*’

*Characters.*—In shape like the segment of a sphere; black, except at the hilum, which is brown and somewhat hairy; varying in size up to  $\frac{1}{5}$  inch in length and breadth. Odour earthy; taste acrid.

*Active Principle*.—The official resin (about 8 per cent.).

The resin consists almost entirely of pharbitisin, which is apparently identical with convolvulin (see page 383).

The seeds also contain an acrid fixed oil (about 14 per cent.), tannin, and unimportant substances.

*Dose in powder*.—30 to 50 grains.

**Pulvis Kaladanæ Compositus**.—Consists of kaladana, 5 ; acid potassium tartrate, 9 ; ginger, 1.

*Dose*.—20 to 60 grains.

**Tinctura Kaladanæ**.—1 in 5.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—Its action and uses are similar to those of jalap (page 383). The compound powder has a similar composition to the compound powder of jalap ; its action and uses are the same.

**Kaladanæ Resina**.—The resin obtained from kaladana.

Prepared in similar manner to jalap resin (page 384).

*Characters*.—Brownish, opaque, brittle fragments, translucent at the edges, breaking with a resinous fracture ; odour somewhat disagreeable ; taste sweetish at first, afterwards acrid.

*Constituent*.—Convolvulin (see above).

*Dose*.—2 to 8 grains.

*Pharmacology*.—Its action and uses are the same as those of jalap resin.

#### MYLABRIS

**Mylabris**—a Chinese blistering beetle. ‘The dried beetle, *Mylabris phalerata*, Pallas.’

*Characters*.—About 1 inch long and  $\frac{3}{8}$  inch broad. The black wing-sheaths are marked by two broad wavy transverse orange-coloured bands and a large orange-coloured spot at the base. The odour is somewhat unpleasant.

*Active Principle*.—Cantharidin (about 1 per cent.) (see page 428).

The preparations are the same as those of cantharides (page 428), except that there is no collodion and no tincture. The ingredients and their proportions are exactly the same as those of the corresponding preparations of cantharides, the only difference being the substitution of mylabris for cantharides.

**Acetum Mylabridis**.—1 in 10.



**Emplastrum Calefaciens Mylabridis.**—Approximately 1 in 25.

**Emplastrum Mylabridis.**—Approximately 1 in 3.

**Liquor Epispasticus Mylabridis.**—1 in 2.

**Unguentum Mylabridis.**—Approximately 1 in 10.

Other species of mylabris may be used in making the preparations, provided they yield a proportion of cantharidin equivalent to that contained in *Mylabris phalerata*.

*Pharmacology.*—The action and uses of the preparations are the same as those of the corresponding preparations of cantharides (see page 428).

#### MYROBALANS

**Myrobalanum.**—‘The dried immature fruits of *Terminalia Chebula*, *Retz.*’ They are known in commerce as black myrobalans.

*Characters.*—Ovoid or fusiform, black, solid and brittle, much shrivelled longitudinally,  $\frac{1}{3}$  to  $\frac{3}{4}$  inch long, and about  $\frac{3}{8}$  inch wide. The fractured surface is blackish-brown and somewhat shiny. It has no odour, but has a strongly astringent taste.

*Active Principle.*—Tannic acid (20 to 30 per cent.).

**Unguentum Myrobalani.**—Consists of myrobalans, 1; benzoated lard, 4.

**Unguentum Myrobalani cum Opio.**—Consists of opium, 1; myrobalan ointment,  $12\frac{1}{3}$ .

Compare with the preparations of galls (page 416).

*Pharmacology.*—Its action is due to the tannin it contains. The action of the ointments is similar to but somewhat less powerful than the corresponding ointments of galls (see page 416).

#### AJOWAN OIL

**Oleum Ajowan**—ptychotis oil. ‘The oil distilled from the fruit of *Carum copticum*, *Benth. and Hook. f.*’ It should yield 30 to 36 per cent. of crystalline thymol when cooled to 0°C.

*Characters.*—Colourless, with an odour resembling thyme, and an aromatic pungent thyme-like taste.

Specific gravity 0.917 to 0.930.

*Constituents*.—Thymol (about 50 per cent.); cymene and a terpene.

*Dose*.— $\frac{1}{2}$  to 3 minims.

*Pharmacology*.—Its action and uses are similar to those of thymol (page 240) and other volatile oils (page 469).

#### ARACHIS OIL

**Oleum Arachis**—earth-nut oil; ground-nut oil; pea-nut oil. ‘The oil expressed, without the aid of heat, from the seeds of *Arachis hypogæa*, *Linn.*’

*Characters*.—Pale yellow or greenish-yellow, with a slight nutty odour and a faintly nutty oily taste. On exposure to air it slowly thickens and becomes rancid. It becomes turbid at 3°C., and solidifies at  $-5^{\circ}\text{C}$ .

Specific gravity 0.916 to 0.918.

*Constituents*.—Olein mainly.

It also contains the glycerides of hypogæic, arachidic, and lignoceric acids.

It may be used in place of olive oil to make the official preparations (liniments, ointments, plasters) into which this enters.

*Pharmacology*.—Its action is that of a bland fixed oil (see page 540).

#### OIL OF LEMON GRASS

**Oleum Graminis Citrati**—Indian oil of verbena; Indian melissa oil. ‘The oil distilled from *Andropogon citratus*, *DC.*’

*Characters*.—Dark yellow, with an odour resembling that of verbena.

Specific gravity 0.895 to 0.905. It should contain at least 65 per cent. of citral and other aldehydes.

*Chief Constituent*.—Citral (65 to 85 per cent.) (see page 487).

Citronellal, geraniol, linalool, limonene, and other compounds are present. The citral is said to consist of a mixture of two stereo-isomerides.

*Dose*.— $\frac{1}{2}$  to 3 minims.

*Pharmacology*.—Its action is similar to that of other volatile oils (page 469). It is used chiefly as an external application, usually mixed with a fatty oil, for rheumatic and other pains. It may be given internally as a carminative, but is less valuable than some other volatile oils. It is used largely in perfumery.

## CHAULMOOGRA OIL

In the Pharmacopœia this oil is given the name of **Oleum Gynocardiaë**, and is described as 'the fatty oil expressed from the seeds of *Gynocardia odorata*, *R. Brown*, or *Gynocardia Prainii*, *Desprez*.' It is now known that this is not the source of the chaulmoogra oil of commerce, and that gynocardia oil is not a commercial article.

**Chaulmoogra Oil.**—The fatty oil expressed from the seeds of *Taraktogenos Kurzii*, *King*.

*Characters.*—A yellowish or brownish-yellow semi-solid fat, with a characteristic odour and a somewhat acrid taste. It melts at 22° to 23°C. and is consequently an oil at tropical temperatures (impure varieties may not completely liquefy under 42°C.). The greater part is soluble in cold alcohol, and the whole in hot alcohol, and in ether or chloroform.

It may contain a little non-fatty matter, which produces turbidity of its solutions.

*Constituents.*—The glyceryl esters of chaulmoogric and hydnocarpic acids.

Palmitin and the glyceryl esters of one or more undetermined acids also occur.

Chaulmoogric acid ( $C_{18}H_{32}O_2$ ) crystallises in glistening leaflets, melting at 68°C. It is a new type of acid.

Hydnocarpic acid ( $C_{16}H_{28}O_2$ ) also occurs as glistening leaflets, melting at 60°C., and has a similar chemical structure to chaulmoogric acid.

Gynocardic acid, usually given as the active principle, is a mixture of substances.

*Dose.*—5 to 10 minims, gradually increased to from  $\frac{1}{2}$  to 1 fluid drachm.

**Unguentum (Gynocardiaë).**—1 in 10. Paraffin basis.

*Pharmacology.*—Externally applied, it is somewhat irritant. Taken internally, it has an acrid taste, and after swallowing produces an acrid sensation in the throat and a feeling of warmth in the stomach. Large doses produce nausea and vomiting and diarrhœa.

It is used, chiefly externally, in leprosy, chronic eczema, and other chronic skin diseases. It is also given internally in the same conditions. It has been given in syphilis and phthisis, but with questionable benefit.

## SESAME OIL

**Oleum Sesami**—benne or teal oil. ‘The oil expressed from the seeds of *Sesamum indicum*, *Linn.*’

*Characters*.—A pale-yellow, mobile oil, with a slight odour and a bland taste. It congeals at  $-5^{\circ}\text{C}$ .

Specific gravity 0.921 to 0.924. The oil can be distinguished from other fixed oils by shaking vigorously with an equal volume of a mixture of 6 per cent. pyrogallol in hydrochloric acid, and boiling the lower acid layer for five minutes. If sesame oil has been employed, the liquid becomes purple by transmitted and blue by reflected light. The reaction is due to the presence of sesamol.

*Constituents*.—Olein (about 75 per cent.); palmitin; stearin; myristin.

Small quantities of sesamol, sesamin, and other substances.

It may be employed in making the official liniments, ointments, and plasters for which olive oil is directed to be used.

## PICRORHIZA

**Picrorhiza**.—‘The dried rhizome of *Picrorhiza Kurroa*, *Royle.*’

*Characters*.—Light, fragile pieces, 1 to 2 inches in length, and  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in diameter. The lower portion is covered with a greyish-brown, shrivelled, corky bark, and is marked by the prominent scars of rootlets. The thicker upper end is thickly set with dark greyish-brown scales arranged in the form of partial annulations, and terminates in a scaly leaf-bud or stem. The fracture is short, the fractured surface black, but showing a narrow imperfect ring of a paler colour. It is without odour, but has a very bitter taste.

*Chief Constituents*.—Picrorhizin, a bitter, crystalline glucoside; cathartic acid?

Picrorhizin on hydrolysis yields picrorhizetin and dextrose. It is readily soluble in water and alcohol.

**Extractum Picrorhizæ Liquidum**.—1 in 1.

*Dose*.—20 to 60 minims.

**Tinctura Picrorhizæ**.—1 in 8.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—In small doses it has the action of a bitter (page 453), and is used as such. Large doses are employed in



malaria and malarial conditions. In these doses it has a slight laxative action.

#### INDIAN PODOPHYLLUM RHIZOME

**Podophylli Indici Rhizoma.**—‘The dried rhizome and roots of *Podophyllum Emodi*, *Wall.*’

*Characters.*—Earthy-brown, horizontal,  $\frac{1}{4}$  to  $\frac{1}{3}$  inch thick, more or less cylindrical and contorted, crowded on the upper surface with tuberosities, which are marked with depressed oval or circular scars, and giving off from the whole of the under surface numerous rootlets. Fracture short; the fractured surface is white and mealy, or yellow and horny, and shows a circle of yellow fibro-vascular bundles and a thin brown cortex. The odour is faint, the taste bitter and acrid.

The tuberculated appearance and the roots arising from the whole of the under surface readily distinguish this from *Podophyllum rhizome* (page 435).

*Active Principle.*—The official resin (see below) (10 to 12 per cent.).

The resin consists of podophyllotoxin and podophyllo-resin with small quantities of pieropodophyllin and other substances. It is said to contain a much larger percentage of podophyllotoxin than the resin from American *podophyllum* (see page 436).

It is used chiefly for preparing the resin.

#### **Podophylli Indici Resina.**

Prepared in the same manner as *podophyllum resin* from *podophyllum rhizome* (see page 436).

*Dose.*— $\frac{1}{4}$  to 1 grain.

**Tinctura Podophylli Indici.**—Contains 2 grains of the resin in 1 fluid drachm.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action and uses are similar to those of *podophyllum resin* (page 436). On account of the greater quantity of podophyllotoxin present it is more powerfully active.

#### SAPPAN

**Sappan.**—‘The heart-wood of *Cæsálpinia Sappan*, *Linn.*’

*Characters.*—Orange-red chips, or hard, heavy pieces, easily split longitudinally, and showing in transverse section concentric

rings and numerous fine medullary rays. It has no odour, and only a slightly astringent taste.

*Chief Constituent*.—Sappanin, a crystalline colouring principle.

It resembles somewhat hæmatoxylin, but gives a carmine-red with alkalis. By this test sappan can be readily distinguished from logwood.

**Decoctum Sappan.**—1 in 20.

Sappan, 1 oz.; cinnamon bark, 70 gr.; distilled water to make 20 fl. oz.

*Dose*.— $\frac{1}{2}$  to 2 fluid ounces.

*Pharmacology*.—Its action and uses are the same as those of logwood (page 423).

#### TINOSPORA

**Tinospora.**—‘The dried stem of *Tinospora cordifolia*, *Miers*, collected in the hot season.’

*Characters*.—Cylindrical, straight or twisted pieces or transversely cut slices,  $\frac{1}{4}$  to 2 inches in diameter. The bark is brown or greenish-brown, smooth and wax-like, but strongly shrunk and marked with deep longitudinal fissures and numerous round elevated scars. It is easily separated from the underlying wood. The fracture is tough and fibrous. The transverse section shows a yellowish-grey porous wood, separated into wedge-shaped bundles by distinct starchy medullary rays. It has no distinctive odour, but has a bitter taste.

Compare with *cissampelos* (page 594).

*Chief Constituents*.—Berberine, a yellow crystalline alkaloid (see page 590); a glucoside.

Starch is present, hence the infusion is made with cold water.

**Infusum Tinosporæ.**—1 in 10.

It is made with cold water.

*Dose*.— $\frac{1}{2}$  to 1 fluid ounce.

**Liquor Tinosporæ Concentratus.**—1 in 2.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

**Tinctura Tinosporæ.**—1 in 5.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—Its action and uses are chiefly those of a bitter (page 453). Like other drugs containing berberine (see page 590), it has been used in malaria, but it is not a reliable remedy.

## TODDALIA

**Toddalia.**—‘The dried root-bark of *Toddalia aculeata*, *Pers.*’

*Characters.*—Quilled pieces,  $\frac{1}{12}$  to  $\frac{1}{8}$  inch thick. The outer bark is soft, yellowish, and fissured longitudinally, but may be denuded in parts, exhibiting the bright-yellow or brown subjacent layers. The inner surface is brown and somewhat granular. Fracture short. The transverse section shows a yellowish outer layer, a narrow, bright-yellow intermediate layer, and an inner broader, brown, radiate layer containing oleo-resin cavities. The odour is faintly aromatic; the taste is bitter, aromatic, and pungent.

*Chief Constituents.*—A bitter principle; resin; a volatile oil.

The oil has a citron-like odour.

**Infusum Toddaliæ.**—1 in 10.

*Dose.*—1 to 2 fluid ounces.

**Liquor Toddaliæ Concentratus.**—1 in 2.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action and uses are those of an aromatic bitter (page 454). It has been employed in malaria, but it has no specific action in this disease.

## TURPETH

**Turpethum**—Indian jalap. ‘The dried root and stem of *Ipomœa Turpethum*, *R.Br.*’

*Characters.*—Occurs usually in short lengths  $\frac{1}{2}$  to 2 inches in diameter. Externally dull grey, having a twisted rope-like or columnar appearance, owing to the presence of deep longitudinal furrows. The transverse section shows a broad cortex and a central porous wood, which, however, is frequently absent, having been extracted by making a longitudinal incision down the bark. The fracture of the bark is short, of the wood fibrous. The odour is faint; the taste, after chewing, nauseous.

*Active Principle.*—A resinous substance, turpethin (convolvulin?) (about 10 per cent.).

*Dose in powder.*—5 to 20 grains.

**Tinctura Jalapæ Composita.**—Contains the active ingredients of jalap 8, scammony 2, turpeth 1, in 100 fluid parts.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—Its action is similar to that of jalap, and it may be used for the same purposes (page 383).

## TYLOPHORA LEAVES

**Tylophoræ Folia**.—‘The dried leaves of *Tylophora asthmatica*, *Wight et Arnott*.’

*Characters*.—Thick, somewhat leathery leaves, 2 to 5 inches long,  $\frac{3}{4}$  to  $2\frac{1}{2}$  inches broad, lanceolate-ovate to sub-rotund in shape, entire, abruptly acuminate, usually cordate at the base, and petiolated. Upper surface brownish-green and glabrous; lower surface yellowish-green and pubescent. Odour faint, taste slightly acid.

*Chief Constituent*.—Tylophorine, a crystalline alkaloid.

*Dose in powder*.— $\frac{1}{4}$  to 2 grains as an expectorant, 15 to 30 grains as an emetic.

*Pharmacology*.—Its action and uses are practically the same as those of ipecacuanha root (page 341). It is said to be of considerable service in dysentery.

## URGINEA

**Urginea**.—Indian squill. ‘The younger bulbs of *Urginea indica*, *Kunth*, also the younger bulbs of *Scilla indica*, *Baker*; taken soon after the plant has flowered.’

*Characters*.—1. *Urginea indica*. About the size of a common onion; consists of whitish, fleshy scales, which enclose each other completely.

2. *Scilla indica*. Somewhat smaller, and the scales are imbricated. The taste of both varieties is bitter and acid.

*Active Principles*.—The same, so far as is known, as those of squill (see page 362).

The preparations are identical in all respects with those of squill (see page 363), except that urguea is employed in place of squill.

**Acetum Urgineæ**.—1 in 8.

*Dose*.—10 to 30 minims.

**Syrupus Urgineæ**.—The acetum saturated with sugar.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

**Oxymel Urgineæ**.—Approximately 1 in 15. (See Oxymel Scillæ, page 363).

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.



**Pilula Urgineæ Composita.**—Slightly less than 1 in 4.  
(See page 363.)

*Dose.*—4 to 8 grains.

**Pilula Ipecacuanhæ cum Urginea.**—Approximately 1 in 6 of urguinea and 1 in 20 of opium (see page 317).

*Dose.*—4 to 8 grains.

**Tinctura Urgineæ.**—1 in 5.

*Dose.*—5 to 15 minims.

*Pharmacology.*—Its action and uses, and those of its preparations, are the same as those of squill (see page 362).

#### INDIAN VALERIAN RHIZOME

**Valerianæ Indicæ Rhizoma.**—‘The dried rhizome and rootlets of *Valeriana Wallichii*, DC.’

*Characters.*—Dull-brown crooked pieces, about 2 inches long and  $\frac{1}{4}$  to  $\frac{1}{2}$  inch wide, marked by transverse ridges and numerous prominent circular tubercles. The transverse section is greenish brown in colour. The odour is similar to that of valerian rhizome, but is more powerful.

*Chief Constituents.*—Practically the same, so far as is known, as those of valerian rhizome (page 492).

**Tinctura Valerianæ Indicæ Ammoniata.**—Composition the same as ammoniated tincture of valerian (page 492), except that Indian valerian is used.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action and uses are the same as those of the European valerian (page 492).

#### BLACK HAW

**Viburnum.**—‘The dried bark of *Viburnum prunifolium*, Linn.’

*Characters.*—Thin, slightly-curved pieces, covered by a greyish or reddish-brown outer bark, which easily peels off and may be absent in patches, revealing the reddish-brown or yellowish-red underlying tissue. Or quills with a glossy, purplish-brown bark marked by scattered warts and minute black dots. The inner surface is pale reddish-yellow and longitudinally striated. The fracture is short. The odour is faint (somewhat valerian-like), the taste slightly bitter.

*Chief Constituents.*—Two bitter, resinous substances ; valerianic acid ; tannin.

**Extractum Viburni Prunifolii Liquidum.**—1 in 1.

*Dose.*—1 to 2 fluid drachms.

*Pharmacology.*—Administered to animals, it depresses the motor centres and the spinal cord without apparently influencing consciousness or sensibility. Large doses cause a marked fall of blood-pressure, probably by depressing the vaso-motor centres, and may cause death from stoppage of the heart.

It has been used in a large number of diseases with equivocal results. It is apparently of greatest service in spasmodic conditions—asthma, hysteria, &c.—but it has been used most extensively in affections of the uterus—dysmenorrhœa, hæmorrhage, to diminish the tendency to abort, &c. It is said to produce, in some individuals, headache and slight loss of co-ordination.

A so-called spirituous extract of liquorice is official for India and the Eastern colonies. It may be employed instead of the liquid extract (page 393).

**Extractum Glycyrrhizæ Spirituosum.**—Contains 1 of extract of liquorice in 2 fluid parts.

Extract of liquorice, 10 oz.; alcohol (90 per cent.), 5 fl. oz.; distilled water to make 20 fl. oz.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

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## AUSTRALASIAN COLONIES

SOME of the drugs official in Australasia are official in India and the Eastern colonies, and have been described. These are Agropyrum and Oleum Arachis. Acacia bark and Alstonia, although official in India and the Eastern and Australasian colonies, are derived from two different species in each instance, and each variety of the drug possesses distinctive characters, and, in the case of alstonia, somewhat different principles. The varieties obtained in Australia, and used principally there, are most conveniently described in this section. Grindelia, which is also official in the North American colonies, is described later.

## ACACIA BARK

**Acaciæ Cortex.**—The dried bark of *Acacia arabica*, *Willd.*, or of *Acacia decurrens*, *Willd.*, obtained from trees not less than seven years old, and kept one year after drying before being used.

*Characters.*—1. *Acacia arabica*. See page 583.

2. *Acacia decurrens*. Black wattle bark. Somewhat twisted incurved pieces, 1 to 2 inches broad, and  $\frac{1}{16}$  to  $\frac{1}{8}$  inch thick. Externally greyish-brown, often marked with ash-grey blotches, irregular longitudinal ridges, and sometimes with transverse cracks. Internally pale reddish-brown, smooth, and longitudinally striated. Fracture fibrous. Odour tan-like; taste astringent.

*Chief Constituents.*—Tannin (30 to 40 per cent.); gum.

**Decoctum Acaciæ Corticis.**—1 in 16.

*Dose.*— $\frac{1}{2}$  to 2 fluid ounces.

*Pharmacology.*—See page 583.

**Agropyrum.**—See page 585.

## ALSTONIA

**Alstonia.**—‘The dried bark of *Alstonia scholaris*, *R. Brown*, and of *Alstonia constricta*, *L' v. M.*’

*Characters.*—1. *Alstonia scholaris*. See page 586.

2. *Alstonia constricta*. Curved pieces or quills, up to 3 inches in width and  $\frac{1}{2}$  inch in thickness. Externally rusty-brown, strongly rugose, being marked with large deeply fissured reticulations, and sometimes bearing small, white, foliaceous lichens. Internally cinnamon-brown, marked with coarse longitudinal striæ. Fracture short, granular in the outer layer, fibrous in the inner portion. Odour faintly aromatic; taste very bitter.

*Chief Constituents.*—Alstonine; porphyrine; porphyrosine (all amorphous alkaloids); alstonidine, a crystalline alkaloid.

**Infusum Alstoniæ.**—1 in 20.

*Dose.*— $\frac{1}{2}$  to 1 fluid ounce.

**Tinctura Alstoniæ.**—1 in 8.

*Dose.*— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology.*—Its action is chiefly that of a bitter, and it is used as such (page 453). It appears also to be of value in intermittent and other fevers, but is inferior to cinchona bark (see also page 586).

**Grindelia.**—See page 613.

## AUSTRALIAN LEECHES

**Hirudo Australis.**—‘*Hirudo quinquestriata*, *Schmarda*, the Five-striped or Australian Leech.’

*Characters.*—Similar to those of European leeches, but possessing only 5 longitudinal stripes on the dorsal surface, which is also lighter and browner in colour (‘greenish-yellow-brown’). There are no spots on the ventral surface. The jaws have 48 to 50 teeth.

*Pharmacology.*—See page 579.

## KAVA RHIZOME

**Kavæ Rhizoma.**—‘The decorticated, dried, and divided rhizome, without the roots, of *Piper methysticum*, *Forster*.’

*Characters.*—Irregularly cuboid or somewhat wedge-shaped pieces, whitish or pale brownish-grey in colour, and  $\frac{1}{2}$  to 2 inches or more in thickness. The fracture is starchy. The transverse section shows a central portion of a close even texture, which is surrounded by a ring of narrow radiating vascular bundles separated by paler medullary rays. The odour is slight but characteristic; the taste, after chewing, is piperaceous and slightly bitter and saponaceous.

*Chief Constituents.*—Two resinous substances known as  $\alpha$  and  $\beta$  kava resin.

Two crystalline substances—kavain (methylen-protocatechuic aldehyde) and methysticin (methysticinic acid methyl ester)—and a volatile oil also occur.

**Extractum Kavæ Liquidum.**—1 in 1.

*Dose.*—30 to 60 minims.

*Pharmacology.*—In small doses kava-kava produces a sense of well-being, and slight diuresis. Large doses produce nausea, somnolence, tremors, and more or less paralysis of the limbs. The resins applied locally cause a burning sensation followed by well-marked anæsthesia.

It is used principally in the treatment of inflammatory conditions of the bladder and urethra, more especially gonorrhœa.

## EUCALYPTUS KINO

**Kino Eucalypti**—Botany Bay kino. ‘An exudation from the stem of various species of *Eucalyptus*.’

*Characters and Constituents.*—Similar to those of kino (page 417).



It often contains fragments of bark, &c., which must be removed before use.

*Dose*.—5 to 20 grains.

It may be used in place of East Indian kino to make the preparations into which this enters.

*Pharmacology*.—Its action and uses are the same as those of East Indian kino (see page 418).

**Oleum Arachis**.—See page 601.

#### OLIVER BARK

**Oliveri Cortex**.—black sassafras. ‘The dried bark of *Cinnamomum Oliveri*, *Bailey*.’

*Characters*.—Flat pieces, about 8 inches long and  $1\frac{1}{2}$  inches wide, covered with a coarsely granular outer bark of a deep orange-brown colour marbled with yellowish-brown patches and sometimes bearing moss. The inner surface is umber-brown in colour and has a somewhat satiny surface marked with fine striæ. The odour is aromatic and characteristic; the taste is spicy and camphoraceous.

*Chief Constituents*.—A volatile oil (about 1 per cent.); tannin.

The oil is bright yellow and contains safrol, cineol, eugenol, and cinnamic aldehyde.

**Tinctura Oliveri Corticis**.—1 in 10.

*Dose*.— $\frac{1}{2}$  to 1 fluid drachm.

*Pharmacology*.—Its action is the same as that of other drugs containing a volatile oil (page 469), and it is used for the same purposes.

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#### NORTH AMERICAN COLONIES

Certain drugs and their preparations which are official in these colonies are also official in India and the Eastern colonies, and have consequently been described. These are *Agropyrum*, *Catechu Nigrum*, *Gossypii Radicis Cortex*, *Oleum Sesami*, *Turpe-thum*, and *Viburnum*.

**Agropyrum**.—See page 585.

## ARNICA FLOWERS

**Arnicae Flores.**—‘The dried flower-heads of *Arnica montana*, *Linn.*’

*Characters.*—Depressed roundish composite flower-heads from 1 to 1½ inches broad. The involucre consists of two rows of dark green, linear-lanceolate, hairy bracts. The ray florets are about 16 in number and have ligulate, 3-toothed yellow corollas. The numerous disc florets are yellow and tubular. The slender spindle-shaped achenes are crowned by a hairy pappus. The receptacle is nearly flat and hairy. The odour is slightly aromatic; the taste somewhat bitter and acrid.

*Active Principles.*—The same as the rhizome (see page 433), but no tannin.

**Tinctura Arnicae Florum.**—1 in 10.

*Dose.*—½ to 1 fluid drachm.

*Pharmacology.*—See page 433.

**Catechu Nigrum.**—See page 593.

**Gossypii Radicis Cortex.**—See page 596.

## GRINDELIA

**Grindelia.**—‘The dried leaves and flowering tops of *Grindelia squarrosa*, *Dunal*, and of *Grindelia robusta*, *Nuttall.*’

*Characters.*—Leaves pale-green, smooth, rigid, brittle, sessile, broadly spatulate to somewhat lanceolate, with a more or less serrated margin. The flower-heads are yellow, hard, and resinous. The stalks are smooth, rounded, and yellow or pale brown. The odour is balsamic; the taste is pungently aromatic and bitter.

The flower-heads of *G. squarrosa* are nearly conical; those of *G. robusta* are depressed globular. The leaves of *G. squarrosa* are more coarsely serrate than those of *G. robusta*.

*Chief Constituent.*—A resin.

Small quantities of a volatile oil, a phytosterol and hentriacontane have been isolated.

**Extractum Grindeliae Liquidum.**—1 in 1.

The drug is extracted with alcohol, the alcohol evaporated, and the residue dissolved in a mixture of sodium bicarbonate and distilled water. Alcohol (one-third volume) is subsequently added.

*Dose.*—10 to 20 minims.

*Pharmacology*.—Besides the effects due to its bitter and aromatic properties, it is said to depress the brain and spinal cord, and to regulate cardiac activity and increase blood-pressure. It acts as a slight expectorant and diuretic.

It is chiefly used in asthma, whooping cough, and chronic bronchitis; less frequently in chronic inflammatory conditions of the genito-urinary tract.

#### OIL OF GAULTHERIA

**Oleum Gaultheriæ**—oil of wintergreen. ‘The oil distilled from the leaves of *Gaultheria procumbens*, *Linn.*, or from the bark of the sweet-birch, *Betula lenta*, *Linn.*’

*Characters*.—Colourless or slightly yellow, with a strong characteristic odour and an aromatic sweetish taste. It has a slightly acid reaction. Slightly soluble in water; readily soluble in alcohol, ether, or chloroform.

Specific gravity 1.176 to 1.187.

*Chief Constituent*.—Methyl salicylate (99 per cent. or more).

Small quantities of an alcohol, an aldehyde or ketone, and an ester, occur in oil of wintergreen, and the ester occurs in oil of sweet-birch, and to these substances part of the characteristic odour of the oils is due.

The oils do not occur naturally in the plant. They are formed by the hydrolysis of a glucoside, gaultherin, by means of a ferment, betulase.

*Dose*.—3 to 10 minims.

*Pharmacology*.—Its local action is that of a volatile oil (page 469), its general action that of salicylates (page 247). It is readily absorbed from the skin and from the alimentary canal, is decomposed in the system forming an alkali salicylate, and is excreted as salicylates are excreted.

It is used in acute rheumatism and rheumatic affections, but possesses no advantages over sodium salicylate for internal administration; its local irritant effect is a disadvantage when large doses have to be administered. Applied locally, however, it is often beneficial in subacute and chronic forms of rheumatism.

**Oleum Sesami**.—See page 603.

**Turpethum**.—See page 606.

**Viburnum**.—See page 608.

## WEST INDIAN COLONIES

All the drugs official in these colonies are also official in India and the Eastern colonies, and have consequently been described.

**Daturæ Folia.**—See page 595.

**Gossypii Radicis Cortex.**—See page 596.

**Oleum Graminis Citrati.**—See page 601.

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## AFRICAN COLONIES

The drugs official in these colonies are also official in India and the Eastern colonies.

**Mylabris.**—See page 599.

**Oleum Arachis.**—See page 601.

**Oleum Sesami.**—See page 603.

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## MEDITERRANEAN COLONIES

Only one drug is official.

## MELON PUMPKIN SEEDS

**Cucurbitæ Semina Præparata.**—‘The prepared fresh ripe seeds of cultivated plants of *Cucurbita maxima*, *Duch.*’ The seeds must not be more than 1 month old.

*Characters.*—Flat broadly ovate seeds,  $\frac{1}{3}$  to  $\frac{3}{4}$  inch long,  $\frac{3}{8}$  to  $\frac{1}{2}$  inch broad, and  $\frac{1}{16}$  to  $\frac{1}{12}$  inch thick, with a yellowish membranous outer and a thin brown inner coat, enclosing two flat white cotyledons which form the official drug. These have a faint odour and taste.

The seeds are ‘prepared’ by depriving them of their two coats, which must be done shortly before use.



*Active Principle.*—An acrid resin ?

An alkaloid—cucurbitine—has been described, but it is doubtful whether it exists. The other constituents are fixed oil, proteids, starch, &c.

*Dose.*—3 to 4 ounces, bruised with a little water or milk to a creamy consistence.

*Pharmacology.*—The seeds are used only as an anthelmintic for tapeworms. They are less certain than liquid extract of male-fern, but are pleasanter to take. The general method is similar to that previously described (page 441).

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